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THE A. I. E. E. WHITE MOUNTAINS CONVENTION.

Notwithstanding the slim attendance last week at the annual A. I. E. E. convention, which registered only 178, including guests, thus making the lowest record for many years, the meeting in several respects was a successful one. With only 20 items on the program, in only a few cases was there an insufficiency of time for the proper presentation and discussion of the papers. Moreover, the limit set to the program resulted in eliminating papers of a purely commercial or highly specialized character, and those presented were, in fact, of general interest and of high grade. Although there were available at the meeting place numerous sources of entertainment for those who wished to indulge in pleasure, the side attractions were not such as to interfere with the attendance at the technical meetings, for which primarily a convention is held.

Aside from the presentation and discussion of papers, abstracts of some of which are given elsewhere in this issue, much interest was manifested in the subject of local sections, almost all of which were represented by delegates. Owing to the improved standing given to sections during President Stillwell's administration, to the encouragement now being offered for individual effort by the local sections and to the promised increased co-operation among the sections and with the Institute administration, there should be an early widening of the influence of the A. I. E. E. geographically. It would appear, however, that in order to enable any broad sectional policy to be developed and put in action, its principles should be incorporated in the organic law of the institute, and thus not exposed to frequent tinkering and occasional lapses in enforcement.

Among the items of general interest on the program were certain suggested amendments to the standardization rules which will be submitted to the membership of the Institute for approval. Most of the amendments relate to definitions of apparatus that has been developed recently or has become of importance industrially during recent years. Changes of this nature represent progress in electrical engineering application, and it is fitting that the devices introduced should be properly and uniformly designated by all who have occasion to refer to them. A noteworthy exception is found in a new definition of "efficiency" as a "physical dimensional quantity." It would seem that this definition had been introduced for the purpose of covering an incorrect designation of the specific output of an electric lamp which has appeared in the standardization rules of the Institute for many years. Just why the addition of a second error in the form of an incorrect term should be considered to correct the existing error it is difficult to perceive. Any argument based upon the fact that the specific output of a lamp in candles per watt is often referred to as an efficiency carries no weight whatsoever, for an examination of existing electrical engineering literature will show a still greater use of the term "efficiency" for the specific consumption in watts per candle. Moreover, the argument that the term efficiency can

correctly be applied to the specific output in candles per watt owing to its occasional use in this connection has in this case no standing for the reason that the Institute rule is in itself responsible for the prevalent inaccurate use of the term.

Three of the papers presented are of especial interest at this time dealing as they do with phenomena which are of predominating importance at the limits of electrical engineering development now being reached by certain of the latest long-distance installations, namely, the dielectric strength of air and of oil. Valuable information concerning the properties of transformer oil was given in a paper by Mr. H. W. Tobey. A convincing investigation of the critical disruption voltage of the air surrounding a transmission conductor was reported by Prof. J. B. Whitehead. Results of a surprising nature were reported by Dr. C. P. Steinmetz and Mr. J. L. R. Heyden in a paper dealing with the disruptive strength of oil and air with transient voltages. The investigations made by the last-named authors indicated that even in air the disruptive discharge requires not merely a sufficiently high voltage, but an application thereof for a finite though small period of time. That is to say, a definite minimum amount of energy must be expended in the dielectric before disruption takes place. It has been known for many years that solid and liquid dielectrics are able to resist for a short time e.m.fs. much in excess of the voltage which they can withstand continuously, but it has usually been assumed that the break-down of air takes place instantaneously. According to the investigations reported by Messrs. Steinmetz and Heyden an exactly similar effect is found in air when used as the dielectric, the only difference being in the time required for break-down and the energy consumed previous to disruption. The authors expressed the belief that the "disruptive energy" of oil is about 30 times as great as that of air, and that of solid dielectrics is probably still greater. The existence of a greater "time lag of discharge" in oil or solid dielectrics than in air is of more than theoretical interest, since it renders possible the effective protection, from lightning and similar transient phenomena of generating and transforming apparatus, by a spark-discharge air-gap across which an arc will form with such rapidity as to relieve the system of the excess voltage before the insulation of the apparatus can be punctured.

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The first annual report of the International Electrotechnical Commission has just been published in the French and English languages, side by side. The document is notable in that it presents the status of international co-operation toward unity of standards in electrical machinery, of nomenclature, and symbology in electrotechnical literature. It is to be hoped that this first report will be the herald of a succession of valuable achievements along these and other electrotechnical lines. The subjects which have thus far occupied the attention of the commission are nomenclature, the unit of candle-power, symbols, and standards for electric machinery. In regard to electrotechnical nomenclature, it is evident that before machinery and apparatus can be internationally standardized it is necessary to have precise mutual recognition of the terms and definitions involved. Consequently, a certain amount of definite nomenclature is a prerequisite to standardization work. The preparation of such definitions has occupied the attention of several national committees, and especially of the British, Danish and French committees, which have prepared certain lists of definitions of technical terms. Within the empire of the commission, the divisions in industrial practice, as well as in technological practice, are practically the same as the divisions of language, so far as concerns the continent of Europe. That is to say, very little difference of opinion or of tradition is likely to be expected within the borders of France, or Germany, or Italy. Engineers speaking the same language are accustomed, in general, to think alike, and to act alike, in these matters. Differences of opinion and differences of technical custom are only to be expected with differences of language. The English language forms a curious exception. Engineers speaking the English language come from India in Asia, The Cape in South Africa, England in Europe, Canada and the United States in America, New Zealand and Australia in Australasia. The differences in local conditions and in engineering practice between the United States and England are at least as great as any existing within the boundaries of Europe. These differences engender differences in usage, and in definitions that no committee can either ignore or control. Consequently, when we come to the English language, we find the system of natural cleavage does not coincide with the system of language difference. All we can hope to accomplish with Great Britain, in this matter, is to accord with its nomenclature wherever possible, and, in return, to ask that terms which cannot be harmonized, owing to fixed difference of usage across the Atlantic, may be omitted from official definition as far as possible.

In regard to the unit of candle-power, England, France and the United States have, through the initiative of the Illuminating Engineering Society, agreed upon a common international unit, but the movement rests at this stage. In regard to symbols for the principal quantities in electrical engineering literatude, the British committee has proposed that attention be concentrated at first upon the symbols entering into Ohm's law. The outcome of this suggestion has not yet been vouchsafed. Unfortunately, there is more difference of established usage on the symbols for current strength and for resistance entering Ohm's law than on almost any other quantity; whereas upon about a dozen quantities there already exists almost complete international agreement in usage. To commence with Ohm's law is, therefore, to attack the problem along the lines of most resistance. In regard to standards for machinery, no formal action has yet been attempted.

An informal conference has been called, by the courtesy of the Belgian committee, for the week of Aug. 7-13 this year, in Brussels. It is understood that while there will be no formal voting, there is to be a free interchange of opinions, particularly with respect to machinery ratings, with perhaps some record of any resolutions reached. It is to be hoped that, at this meeting, such exchange of views may occur as may lead to the formulation of definite proposals for consideration at the official meeting, expected to be held at Berlin in 1911. It would certainly be a sad requiting of the courtesy of the Belgian committee if the gathering this year broke up without leading to potential co-operation, in addition to personal acquaintanceship.

THE PRECISION OF PHOTOMETRY.

In a recent paper before the Illuminating Engineering Society (British) especial attention was given, partly by design and partly by accident, to the question of the practical precision of photometric measurements under different conditions and with different types of instruments. The general consensus of opinion was not altogether comforting to the photometrist. As to the particular type of photometer giving the best results there was sufficient disagreement to leave an impression of uncertainty. It is very curious that long as the Bunsen and Lummer-Brodhun types of photometers have been in use, their relative value as instruments of precision still remains in doubt. Most authorities agree that the Lummer-Brodhun contrast prism gives somewhere about half the average error of setting obtained with the Bunsen disk, assuming the lights to be of the same color. Yet a few experienced men claim that the latter can be made as sensitive as the former even in its original form of the grease spot.

It has been our strong impression that if any type of the Bunsen screen is comparable with the Lummer-Brodhun instrument, it is the modification known as the Leeson disk, where the translucent spot is obtained by placing thin paper between two opposed holes in cardboard. A disk of this form made in the shape of a deep pointed star certainly gives good results, yet we should greatly hesitate to believe that it is capable, even with lights of the same color, of giving quite as good results as the contrast prism or even as the ordinary Lummer-Brodhun prism. With either of the latter forms the mean error of a single setting is considerably less than 1 per cent, while few reports from the Bunsen photometer are quite so good as this, especially for the grease-spot variety. The contrast prism, in fact, can usually be trusted to work pretty steadily down to 0.3 or 0.4 of a per cent as the mean error of a single setting. When it comes to comparing lights of different colors the situation is much more complicated. Some observers get much better results with the Bunsen screen than with the Lummer-Brodhun instruments, while others find very little difference between the two, an added proof of the very large subjective factor in all photometric measurements. Extraordinary and perhaps ill-founded claims have been made for the flicker photometer in the comparison of lights of different colors. In this matter the question is a somewhat intricate one because there are two quite different things to be considered—first, the mean error of setting as compared with the average in a single series of measurements; and second, the constancy of the average obtained on different occasions.

In the first instance it may be regarded as rather doubtful whether the flicker photometer would give any closer readings than any of the other types. This, however, is not the vital question, for consistency is no proof of precision in photometry or elsewhere. In comparing with ordinary photometers two lights of varying color, the observer naturally falls at once into a particular habit of reading, and then is likely to run off his settings with a good deal of precision. Can he, however, come back to the same lights three or four days later after other photometric work has intervened and obtain results consistent with the previous ones? Generally speaking, he cannot, a fact which was beautifully brought out at the meeting in question by a report from the National Physical Laboratory, showing the variations obtained by different observers on different days when comparing two lights even as close in color as an incandescent lamp at 3.1 watts per candle and one at 4 watts per candle. The results of such a comparison on one day may vary by 1 per cent or more from those obtained on the same lamp by the same observer on another day, an error certainly much larger than the mean variation obtained in any single set of readings. There was a sort of rough consistency in the variations from day to day, which may be partly due to idiosyncrasy of the observer and partly due to the entrance of any conditions affecting all the observers alike. The psychological differences, so to speak, would be greatly increased in the case of a greater variation in color than that here considered.

Just how far the flicker instrument can aid in avoiding these inconsistencies between the readings on one day and those on another has not yet been properly shown. Observers who are familiar with the flicker photometer and who like to work with it, claim greatly improved results, while those who find it trying and difficult can hardly be expected to add to its reputation. It is certain that the flicker photometer is for many and perhaps most observers an extremely difficult and trying thing to use, but its precision of setting appears to be much better than seems possible when first using the instrument. It would be rather desirable to have comparative tests of the three or four conspicuous forms of photometers, including one or more varieties of the flicker instrument, by half a dozen independent observers, all measuring the same series of pairs of lamps on several well separated occasions with each of the instruments concerned. Comparative measurements have been made many times, but never yet have any measurements been published taken by enough independent observers under enough diverse conditions to eliminate personal idiosyncrasies. One of the reports on photometry which particularly needs to be examined in the course of such an investigation is that remarkable one from the Netherlands Gas Commission some years since in which the Bunsen photometer is given a degree of merit quite inconsistent with that obtained in any other series of observations. It would be well also to work with chromatic differences at least as great as between a 4-watt carbon lamp and the tungsten lamp, and preferably with differences enhanced by not too strongly tinted screens. The instruments now current are altogether too discordant to be tolerated.

OIL SWITCHES IN CENTRAL-STATIONS.

Among the papers read at the Jefferson Convention of the American Institute of Electrical Engineers, one of particular interest to operating engineers was that of Mr. A. R. Cheyney on the use and behavior of oil switches. As we all know, oil switches are a most important adjunct to a central-station system. Much depends upon their reliable operation if a short-circuit occurs. It is a remarkable fact attested to, both in the paper and in the discussion, that no case has recently occurred in which a central oil switch failed to break a short-circuit when called upon to do so. Nevertheless, many switches have suffered damage in rupturing short-circuits, and they often throw oil badly under stress. The recent tendency of large stations has been to collect larger and larger powers on central-station busbars. As was pointed out in the discussion there is a prudent limit to this procedure. A single oil switch cannot be expected to rupture unlimited power. The necessity

may develop of inserting protective reactances, not only between each generator unit and the busbars, but also between different sections of the busbars. The sectioning of the bars by such insertion of reactances is a clumsy and space-consuming device; but it may be necessary to resort to it in the future in order to set some upper limit to the power that a single oil switch may have to disrupt.

CARBON FILAMENT LAMPS AS PHOTOMETRIC STANDARDS.

An important paper on this topic was presented by Messrs. Rosa and Middlekauff last week before the Jefferson convention of the American Institute of Electrical Engineers. The presentation was timely, in view of the fact that we now happily possess an international standard of candle-power in common with France and Great Britain. It is very important to know what are the probabilities and technical methods of its maintenance over so extensive a domain. The human eye is a marvelous piece of mechanism. It is extremely sensitive to radiant energy within the particular spectral range to which it has become adapted by millions of years of experiments. As yet it stands unrivaled in sensitiveness by any apparatus hitherto made in the laboratory. Moreover, even if we could produce a laboratory instrument which would be capable of responding definitely to the impact on a few square millimeters of radiant energy from a naked candle at the distance of a kilometer our instrumental difficulties would only intensify. It would then become necessary to graduate the sensibility of the instrument in such a manner that it should not respond to any amount of radiant energy outside the visible spectrum, while it should respond to radiant energy within the limits of that spectrum according to a certain curve—the visual sensibility curve—as determined experimentally for the average human eye. The ideal instrument, thus adjusted, would then be capable of measuring luminous intensity and illumination. It is evident, upon considering the difficulty of arriving at such a delicate yet complex mechanism as that above described, that we are very far from realizing any suitable apparatus for measuring light in the subjective sense. Even the much simpler problem of measuring light in the objective sense, by measuring the intensity of impinging radiant energy, wave-length by wave-length, is still far from being satisfactorily solved. Consequently, the human eye remains its own arbiter and measurer. As to the intensity of light or of illumination, the eye itself is the only instrument we possess. We have as yet no means of determining whether the average eye of to-day is the same in its response to radiant energy as the average eye of the last year, or decade, or century. We only know that the response of a particular eye is not quite the same at all ages, and that different eyes are not, in general, quite the same, in the same age, in their relative responses. Setting aside color-blind eyes as markedly abnormal it is questionable whether any two eyes are precisely of the same absolute sensibility at any single wave-length, or of the same relative sensibilities at different assigned wave-lengths.

The paper of Rosa and Middlekauff describes the improvements which have recently been made to produce seasoned carbon incandescent lamps. A new lamp diminishes somewhat in resistance at first. Its resistance then becomes practically stationary for a time, and finally it steadily increases with age. We may assume that the two opposing tendencies are present from the start, the tendency to increase being due to reduction of cross-section as the filament evaporates, and the tendency to decrease being due to a physical modification in the structure of the filament under the influence of voltage and high temperature. The tendency to decrease is most marked at the start, and then more than cancels the steady tendency to increase. After a time the two tendencies cancel for a space, and finally the tendency to decrease is much weakened and is completely overcome by the tendency to increase. The lamp is reliable for standard purposes only during the period of steady resistance, perhaps 100 burning-hours in all. At the Bureau of Standards, by the use of potentiometers, the resistance of the lamp can be supervised throughout the tests. The falling-off in candle-power during the period of stationary resistance has been found to depend in the main upon the condensation of carbon vapor on the walls of the globe, which thereby become blackened and diminished in transparency. To minimize this source of error the standard filaments for the Bureau are inserted in large globes, so as to reduce the density of the condensed and deposited layer. The authors also show that when a lamp, in the steady resistance state, is operated at constant watts, its candle-power is much more nearly steady than when operated either at constant volts, or at constant amperes.

By the use of a double photometer, or two photometers connected in series, the number of photometric measurements that can be taken, in a given number of burning-hours of the standard lamp, can be practically doubled. Moreover, much economy of time has been effected by registering automatically the photometer readings on suitably prepared paper, which eliminates the necessity of computing ratios of inverse square distances. The precision of measurement attainable with the eye, in comparing photometrically two candle-powers of the same color, is only about 1 part in 200, with good photometric apparatus and good observers not specially trained. The Bureau claims, however, a precision of about 1 part in 500, for a single comparison, with specially trained observers. By using six standard lamps of a batch, in rapid succession, the mean precision of the set will increase, by the laws of probability in measurement, with the square root of the number of measurements; so that with half a dozen observations the precision should be at least 1 part in 1000. By employing four trained observers in succession, on the same batch of lamps, the precision will naturally be still further increased. By economizing the burning-hours of a batch of standard lamps the paper shows that they are capable of serving for 100 years, if used twice a year, for half an hour at a time, without exceeding the period of reliable standard use. In the course of that time 6000 comparisons can be made with each lamp, for the maintenance, checking and comparison of international candle-power.

Incidentally, and without desiring to offer undue criticism, it may be asked what possible use there is for standardizing lamps on the hypothesis that they are to be rotated when in use. There may be cases when it is desirable to rotate a lamp under measurement for the purpose of determining its mean horizontal candle-power, although we hope to see this particular measurement soon dropped out of sight in favor of a mean spherical measurement expressed either in candles or lumens; but we fail to see the least necessity for having

standard lamps, in which the highest precision is desired, exposed to the added risk of rotation to no possible good purpose. A standard with a filament of such contour as to give quite uniform horizontal distribution and furnished with suitable sight marks for alignment on the photometer bar is much more convenient and probably also more materially reliable than a rotating standard. Moreover, metallic filament lamps, which are already in very great commercial use, do not lend themselves readily to rotation, even if anyone wants to rotate them; and hence there is less use for real or imaginary measurements in rotation than there ever has been before.

THE ELECTRIFICATION OF RAILROADS.

Last week we printed an abstract of a paper to be presented by Mr. George Westinghouse before the joint meeting in England of the American and British Societies of Mechanical Engineers, and in this issue give an abstract of a paper by Mr. W. B. Potter, to be read at the same meeting. The two papers deal from very different points of view with the larger problems of railway electrification. As might be expected, Mr. Westinghouse holds a brief for single-phase methods as best suited to universal electrification, while Mr. Potter has strong hopes of 1200 volts or higher pressure for direct-current traction, and damns the single-phase system with the faintest possible praise. This much might have been written down without reading the respective papers, but there is much in them beside polemics and they will repay a careful study, Mr. Potter's paper as a résumé of things as they are, Mr. Westinghouse's as an appreciation of things as they might be. The former is looking at the problems as they daily present themselves, the latter is directed to the inscrutable future. Mr. Westinghouse takes the large view that just as time has shown the necessity for a standard gauge on railways so as to permit of the free interchange of rolling stock, just so the future will demand that in the general electrification to which Mr. Westinghouse looks forward, the energy supplied shall be of such kind and so delivered to the locomotives or motor cars that their service shall be interchangeable, even as the service of the steam locomotives is at the present time. It is somewhat unsafe to phophesy save after the fact, yet granting the thesis that the electrification of railway lines will assuredly extend until it is well-nigh universal, then obviously Mr. Westinghouse is right in calling for a universal method of traction. With the indications strongly in favor of his position that direct current is out of the running in operations upon the scale presupposed, Mr. Potter's tacit assumption is that railway electrification must be considered as a thing to be accomplished here and there in response to local necessities as a special requirement and not a general necessity. Granting this premise, there is evidently room for direct-current traction, for three-phase traction on mountain divisions and for the single-phase traction which Mr. Potter considers so uneconomical.

One of the most interesting phases of the psychology of argument is the facile way in which two honest and competent men can reach diametrically opposed conclusions suitable to their desires from the same set of concrete facts. Given the experience of the past decade with direct-current and single-phase traction, Mr. Westinghouse and Mr. Potter come to diametrically opposite conclusions that are based on experience. The former shows by a series of very instructive diagrams that in the large and on the whole the distribution expenses, direct and indirect, are so greatly reduced by single-phase traction that any slight increase in investment and depreciation as regards single-phase locomotives may be quite dropped out of sight. Mr. Potter, on the contrary, proves quite to his satisfaction that expense of upkeep and depreciation and interest on single-phase apparatus is so prodigious as to render it entirely impracticable from the financial standoint, a view which he backs up by many carefully aligned figures. Now it is perfectly clear that one of these excellent gentlemen must be occasionally wrong in his figures, or, what is more probable, in the particular hypotheses which he has chosen as a foundation for his figures.

We are glad to see that Mr. Potter lays stress upon depreciation, which has been sadly neglected in traction equipment of every kind since the earliest days of the art. It would be interesting, however, to discover on what concrete data he bases his estimate that the single-phase locomotive will cost twice as much for maintenance as the direct-current locomotive at either 600 or 1200 volts. If he has concrete and reliable figures on this theme to present, we are quite sure that the engineering public would be most glad to receive the benefit of them. It would be also interesting to ascertain from what data he ascertains alternating-current motor cars for interurban service cost more than three times as much in annual fixed charges as do ordinary 600-volt, direct-current cars. To the casual observer it would look as though Mr. Potter has exaggerated the difference on one side as Mr. Westinghouse very possibly may have on the other. If there are data to back up Mr. Potter's figures we should be most glad to publish them with proper authentication of their origin so that there should be no possible chance for critics to carp at the figures presented. We extend the same polite invitation to Mr. Westinghouse with respect to his figures upon cost of motive power.

Really it would seem as though such mutual laying down of cards upon the table would furnish the only reliable data upon which the engineering public may form just conclusions as to the facts. We have no doubt that both the parties in discussion have presented the facts as they see them from data at hand, but the discrepancy is so great as to require verification from the data. In all these discussions of cost it must be remembered that the chief example of single-phase traction, that on the New York, New Haven & Hartford Railroad, is most emphatically not an example on which it is safe to base estimates of future expense, since in the first place, owing to the lack of independent entrance into New York, the locomotives were enormously more complicated and costly than normal single-phase locomotives for similar service would be; and in the second place, there were some natural and costly expenses incident to reduction to normal practice which should not be laid up against the system. As to the general propositions regarding the probabilities of future service, far be it from us to play the prophet. The logic of development lies with unification of method; the logic of finance, which is that of last resort in industrial matters, lies with the maintenance of the status quo, since most of the American railroads are already so overcapitalized that the question before them is not how to build for the future, but how to get reasonable credit for the necessities of the present.

Plans for Summer Convention New England Section N. E. L. A.

The second summer convention of the New England Section of the National Electric Light Association will be held at The Griswold, Pleasant Point, New London, Conn., on Tuesday and Wednesday, Sept. 13 and 14, 1910. The success of the first summer convention at Newcastle, N. H., in 1909 promises an interesting and enthusiastic meeting this year on Long Island Sound in the home territory of President A. J. Campbell. Since the Newcastle meeting the membership has increased from 240 to 675 members, over 100 members having been added since the winter meeting in Boston. The plans for the New London meeting include a special train leaving Boston at 3 p. m., Monday, Sept. 12, arriving at New London at 5:30 p. m. Transfer to Pleasant Point will be made by steamer, and in the evening the officers, executive committee and accompanying ladies will give a reception. The business sessions will begin on Tuesday, Sept. 13, at 10 a. m. The papers will be limited to four, in order to secure the most thorough reading and discussion. On Tuesday morning there will be a topical discussion of "The Best System of Rates and Charging," based upon the points brought out on the paper by Mr. R. S. Hale on "Central-Station Rates" read before the section at the recent Boston meeting. Special attention will be given to the systematization of rates and charging methods in New England, as considered by a committee appointed at the Boston meeting to attempt to secure some degree of standardization in this matter. Following the rate discussion will be a paper on "The Development of the Electric Sign Business."

Tuesday afternoon will be devoted to a general entertainment, with a banquet in the evening. On Wednesday, Sept. 14, at 10 a. m., the business sessions will be resumed and the topics for consideration will be "Special and Decorative Street Lighting" and the "Best General Policy of Central-Station Publicity." An executive session will be held on Wednesday afternoon. Mr. L. D. Gibbs, Edison Electric Illuminating Company, Boston, is secretary of the New England Section of the N. E. L. A.

Early Construction of Chicago Subway Is Probable.

By a decision of the Illinois Supreme Court, handed down on June 29, the city of Chicago is given power to expend for subway or other traction purposes the "special traction fund" contributed by the surface street railway companies as the city's portion of their receipts under the traction settlement ordinances. This fund now amounts to about $4,350,000, and, in addition, the city, by the terms of the franchise settlement ordinances, can call on the companies to contribute $5,000,000 toward the construction of a subway. Thus there is between $9,000,000 and $10,000,000 in sight, and with the last remaining legal question cleared away it is likely that the work on the long-proposed Chicago subway will be begun within a year, or possibly within a few months.

Mr. Bion J. Arnold, the city's subway engineer, is quoted as saying that the actual working plans for the subway will be ready by fall. The subway will not only relieve the surface of the streets of railways on some of the busiest downtown thoroughfares, but will also provide for water-pipes, gas-pipes, electric wires and other buried utilities.

In its decision the Supreme Court held that the city has power to acquire or construct city railways, and that "street railways," properly construed, mean elevated, surface or underground railways; that the city of Chicago may exercise this power in accordance with the traction ordinance of 1907, and may expend for such purpose either the special traction fund or any other available corporate funds belonging to the city. Undoubtedly the subway will be municipally controlled, as well as municipally built, but perhaps the right of operating it will be leased to a private company.

It is probable that the first section of the subway will be built in State Street, running north from Twenty-second Street to Randolph Street, west to La Salle Street, north through the La Salle Street tunnel under the Chicago River to Chicago Avenue. It is estimated that the cost of construction will be $1,000,000 a mile, exclusive of property damages. This subway will through-route north-and-south surface street railway lines. Whether the elevated trains shall also be taken in the subway, whether the subway shall be of one-deck or two-deck construction, whether there shall be provision for four or six tracks on each level, and whether the subway shall be excavated clear across the street, from building line to building line, with pipe and wire galleries, are questions still to be determined.

Plan Niagara Energy for Detroit.

Following the vote taken by the citizens of Windsor, Ont., the Canadian city opposite Detroit, approving a bond issue of $100,000 to take Niagara power by extending the 110,000-volt transmission line from London, 108 miles distant, a company has been formed in Detroit to purchase the surplus block of 12,000 hp which is available to Windsor, and to import this power for resale in the American city. London, Ont., which has a manufacturing population of over 100,000, will shortly be using Niagara energy for lighting and street-railway operation. Windsor can itself utilize only about 1500 hp or 2000 hp, and proposes to merchandise the rest of its share, if contracted for, to its American neighbor, aggregating about 13,000 hp. For Niagara energy, the Ontario Hydroelectric Commission's rate to Windsor will be $27.50 per hp-year. The Canadian Government withstands the expense of constructing the line to the city limits, the municipality paying for the transforming and distribution plant. The recent vote by Windsor citizens, approving the expenditure of $100,000 for this purpose, was very close—618 voting nay against 622 approving the measure. The company formed to import Niagara energy from Canada is called the Electrical Distributing Company of Detroit. It is composed of Messrs. M. J. Dee, G. H. Hendrie, J. L. Land and P. C. Renaud, of Detroit, and C. E. Fleming, John Davis and W. C. Kennedy, of Windsor. Several large manufacturers are reported to be interested in the proposition and the securing of energy to operate their plants. One has discussed taking a block of 2000 hp in case the deal goes through, it is said. A steam auxiliary station may be built. Mr. Paul C. Renaud, who has been quite active in organizing the American company, recently served as secretary of the Committee of Fifty prominent Detroit business men, which investigated local traction conditions. Detroit is 220 miles from Niagara Falls.

Ohio Independent Telephone Situation.

The Chamber of Commerce, of Pittsburgh, has asked business men of Cleveland, Toledo, Columbus and other Ohio cities to aid in securing better rates from the American Telephone & Telegraph Company on long-distance business. It is claimed by Pittsburgh business men that the recent increase in rates was made without notice and that it is unreasonable and out of proportion to the service rendered. Owing to the close connection between Pittsburgh and all the large cities of Ohio, arising out of the iron and steel, coal, oil and natural gas industries, the telephone wires are used extensively and the advance in rates is felt keenly when the monthly bills for tolls are made up.

The plan contemplates concessions in rates through conferences of business men with representatives of the company, but if nothing is accomplished in this way, then the matter will be taken to the Interstate Commerce Commission which, under a new law, is said to have jurisdiction over interstate telephone rates. Unless the company should be arbitrary in its stand it is the desire of those interested to settle the matter themselves. They say they would not have objected to a reasonable advance if the company could show that it was not making a profit under the old schedule, but the advance is more than 100 per cent in many cases and is considered far too great.

The Hudson Telephone Company has taken charge of the business of both the Bell and the Independent offices at Hudson. Service will be given all subscribers of both exchanges by means of a connection made between them. Later on the Hudson Telephone Company will have an exchange equipped that will serve all from one exchange and the poles and wires will be removed from the streets and put under ground. The exchange will connect with both the Bell and Independent long-distance lines. Hudson is to be a model town under the patronage of Mr. J. W. Ellsworth, the wealthy coal operator, whose birthplace was at that place, and where he now maintains a handsome country home.

Large Vancouver Hydroelectric Development.

The British Columbia Electric Railway Company and the Vancouver Power Company will soon commence the development of water-powers on the outlets of Chilliwack and Jones Lakes outlets in the Chilliwack Valley, about 60 miles east of Vancouver. Tht Jones Lake development will include a huge dam near the northwest end, and a tunnel 10,000 ft. long. The dam will be designed for an eventual head of 50 ft., which will enable 35,000 hp to be developed. Initially the dam will only be built 20 ft. high. The Chilliwack Lake development will similarly include a dam 50 ft. high, only 20 ft. of which is to be completed at once. From the latter dam the water will be carried to the power house, three miles away, by high-pressure steel pipes, which for part of the length will pass through a tunnel as in the case of the other development. The pipe line will converge into that from Jones Lake at a short distance from the power house. It is stated that there will be a fall of 1800 ft. between the lakes and the power house. The present outlet of Jones Lake, as well as that of Chilliwack Lake, will be closed by the dams to be constructed. Fully 50 per cent of the water used in the turbines can be reused for irrigation purposes. The Government has agreed to sell such lands as are necessary for the development at $10 per acre, while the lake rights are held by virtue of a grant from the Provincial Government a number of years ago. The approximate ultimate cost, which does not include the purchase of land and the preliminary work, is $9,357,000. The project will be completed in 2½ to 5 years, although 10 years are allowed by the charter of the companies.

Important Rate Decision in Massachusetts.

The Massachusetts Gas and Electric Light Commission has issued an order under date of June 27 reducing the price of gas from 90 cents to 85 cents on the system of the Charlestown Gas & Electric Company, the reduction taking effect Aug. 1. The decision is of interest on account of the location of the company within the city limits of Boston, its relationship to the Boston, Cambridge and Somerville distributing problems, and the comments of the board upon certain aspects of the rate determination. The petition was brought before the board by customers of the company upon the grounds of price and quality of gas supplied. The company has removed the causes of trouble in regard to gas quality by improving the delivery conditions. Since Jan. 1, 1906, the price of gas sold by the company has been 90 cents net. The price of the Boston Consolidated Gas Company is now 80 cents. The Cambridge Gas Light Company, which supplies that part of the city of Somerville not within the territory of the Charlestown company, charges 85 cents. For several years the company has purchased all of the electricity sold by it from the Boston Edison Company, and since May, 1909, the Edison prices have prevailed. The Charlestown company's gas sales increased from 182,000,000 cu. ft. in 1905 to 230,000,000 cu. ft. in 1909, but increases in operating cost, combined with price reductions, have reduced the gas profits from $68,778 in 1905 to $57,026 in 1909. At the hearing the petitioners urged a reduction in price chiefly on the ground of the 80-cent rate in other portions of the city of Boston.

In its discussion of the rate-making problem the board says: "In a proceeding against a company for a reduction in price, evidence which merely calls attention to prices elsewhere is not conclusive as to the fair rate for the respondent company. Such suggestion, however, is never without force and calls for a careful inquiry as to what differences of condition or circumstances, if any, exist in the companies compared, particularly in the case of adjacent companies and those sharing the area of the same municipality. Perhaps the most important difference between the Charlestown and the Boston Consolidated companies lies in the very great difference in their outputs. The Boston company, selling nearly 20 times the amount of gas sold by the Charlestown company, is able to take advantage of methods and processes economical in their operation, but so costly in their installation as to require an investment which in the smaller company would be prohibitive. It has at the same time other such advantages as are incident to large industrial corporations generally.

"The reduction by the Cambridge company and the resulting differences in rates in different parts of Somerville is a more forceful suggestion relative to the Charlestown company's price. Although the two companies operating side by side have certain notable differences, they have many commercial similarities. They buy their materials in the same market, and the costs of delivery and of wages cannot be appreciably different. Cost in the holder and dividend charges were notably larger in Charlestown per 1000 cu. ft. sold than in the Cambridge. For a number of years both of these companies have paid the same annual dividend of 10 per cent, but for the same rate per cent the cost per 1000 cu. ft. is appreciably larger in Charlestown. . . . . The outstanding capital stock of the Charlestown company is greater in proportion to its output than that of Cambridge. It is also larger as to book values and apparently to the actual values of their respective plants.

"The decisions of the courts seem to establish clearly that a company's reasonable rate of profit is not to be based upon the volume of its outstanding securities, but is dependent rather upon the actual value of the plant devoted to the public use. Whatever may be a fair and reasonable rate of return to either company on this basis, it does not necessarily require that it must be sufficient to maintain the same rate of dividend in both. The Cambridge price and dividend, made as they are voluntarily by the company, may be assumed to be not unreasonably low. The Charlestown dividend is only fair when it can be earned with a reasonable price. Under most conditions a fair and reasonable rate of dividend is a very important factor in determining a reasonable price. Under other circumstances other factors may be of the greater importance.

"In an inquiry like this the board must determine what price is reasonable, not merely for the stockholders, but for the public in view of all the circumstances surrounding the case. The public is in any case entitled to the lowest reasonable price at which a company can afford its service, irrespective of prices elsewhere. But this is not the only rule to be considered, for in process of time and under some conditions, a certain standard of price may become so well established that a company may be bound to meet it even though such action may involve some risk to the continuance of a well-established and otherwise not unfair return. Although companies of this class may exercise a practical monopoly within their respective areas of supply, they are not wholly relieved from the competitive force of rates elsewhere. The reason which apparently led the Charlestown company to reduce its electric prices, both for public and commercial lighting, to the level of those in other parts of Boston, are a virtual recognition of the truth of these propositions.

"In view of the decrease in the company's electric income and the increase in expenses already noted, a reduction in the price of gas may have some temporary effect upon the present rate of dividend. It may, nevertheless, be confidently expected that the price named will yield under all the circumstances a reasonable return upon the value of the property which the company is employing for the supply of gas in the territory which it serves. The board is not convinced that under present condi-

tions the Boston price is a reasonable price for Charlestown. On the other hand, the board has reached the conclusion that the Charlestown company may no longer reasonably charge its customers more than the present price in Cambridge and a part of Somerville, and that there is nothing in the present condition of the company's affairs or in its future prospects to render such a reduction commercially impracticable or inexpedient."

First Aid in Electric Shocks.

Dr. J. E. McGowan, surgeon for the Commonwealth Edison Company and the Chicago Telephone Company, addressed the Electric Club of Chicago at its regular mid-day lunch meeting June 29 on the subject, "First Aid to the Injured with Special Reference to Injuries Due to Electrical Work."

Dr. McGowan first called attention to the fact that while a man may be apparently dead from electric shock, every effort should be used to revive him before giving him up. The first thing is to start the heart to beating, if it has ceased. He cited one case where a man receiving a shock in a switch-house was bounced on the floor by one of his companions to start the heart action. This succeeded, although it was rather rough treatment. The best method is to warm all parts and begin artificial respiration. Heat can be applied by hot-water-soaked cloths or bricks. Anything properly to supply artificial warmth to the body and extremities is good. The Commonwealth Edison Company emergency box has a hypodermic syringe with doses of one-twentieth grain of strychnine to be used for starting heart action, and a pair of tongue forceps for the purpose of drawing the tongue forward out of the throat if it is drawn back. Foremen are instructed in the use of this syringe.

Symptoms of a severe shock are a cold skin, a pallor and sometimes unconsciousness. In the case of electric shocks hysterical condition is sometimes one of the symptoms.

He considered that 500 volts is usually required to kill a person. In one case which came under his notice, a man working behind a switchboard at the Twentieth Street substation of the Chicago City Railway received a 360-volt shock, which killed him. This was the lowest voltage which in his knowledge had caused death. Hysterics and nervous conditions seem more likely to follow low-voltage shocks than high-voltage shocks. A person may be badly burned from a high-voltage shock. On the other hand, a shock of 110 volts, alternating current, such as telephone operators sometimes receive, seems to create a hysterical nervous condition. If a shyster lawyer is able to get hold of such a case he is frequently able to get some temporarily apparent grounds to make out all sorts of absurd claims as to permanent injury done.

Mr. McGowan stated positively that if a person is not killed by electric shock no permanent injury is done by the shock except for the burns which may be received. There are no after-effects and all claims that there are such effects are without foundation. As to the treatment of burns in the first stage, wrap the burns with sterile gauze and send the patient to the hospital. Things which may be safely applied to burns in such cases are any of the following: Oil, solution of soda, boracic acid, a mixture of linseed oil and lime water.

In answer to a number of questions at the close of his remarks, Dr. McGowan said if a man's eyes are suffering from the effect of an electrical flash a cold compress with a solution of boracic acid over the eyes may be applied. A spoonful of boracic acid in a cupful of water is the proper strength. Men recovering from tremendous shocks usually report that they felt at the time of receiving the shock as if they were hit from all directions at once, or as if a house had fallen on them. Electric burns are not usually painful until they begin to heal. There is no way of determining by post mortem examination of the interior of the body whether death was caused by electric shock. Nausea in electrical shock is caused in the same way as in other shocks by reflex action on the nervous system. There is coagulation of the blood at the point where the electric current has passed. Vomiting blood can generally be taken as evidence of internal injury from a fall, and not caused by electric shock where a shock and fall occur together. In the application of hypodermic injection with the syringe care must be taken to have the liquid fill the point of the syringe before insertion, because if air bubbles are injected into the system they may cause an abscess under the skin or a clot of blood if in a vein. As to the danger of giving up hope too soon, he cited a case in Ohio recently where a man was revived after six hours' work. He was black for two hours following shock. A person killed by electric shock is almost always burned. The burn may appear simply as a little black spot at first, but in a few days may develop into a large hole due to the sluffing away of burned flesh.

Electrification of Railroads.

At a joint meeting of the American Society of Mechanical Engineers and the British Institution of Mechanical Engineers, to be held on July 28 in London, Mr. W. B. Potter, railway and traction engineer of the General Electric Company, Schenectady, N. Y., will present a paper entitled "Economics of Railway Electrification."

The author compares the various electric systems now available: The three-phase system is considered as out of the running in the United States for all service except where heavy grades are encountered, and a detailed comparison of the single-phase and high-voltage, direct-current systems results decidedly in favor of the direct-current system.

The development of the commutating pole has made practicable the operation of direct-current motors at voltages considerably in excess of the present standard of 600. A great many roads are now using 1200 volts and 1500 volts, and Mr. Potter suggests that the standard e.m.f. for high-tension, direct-current systems may be as high as 1800 volts or 2400 volts.

Judged from the requirements of interurban service, the author lists the following disadvantages of the single-phase system: Excessive weight of rolling stock; excessive cost of rolling stock; high cost of equipment maintenance; increased power consumption; rapid depreciation of motor; rapid depreciation of car bodies and trucks; increased cost of maintaining tracks and roadbed.

A cost analysis of trunk-line service shows results in favor of the direct-current systems, except where the traffic is light and the distance great. The cost of substations is given as follows: Six hundred volts, direct current, $26 per kilowatt; 1200 volts, direct current, $28 per kilowatt; 11,000 volts single-phase, $11 per kilowatt; 1,000 volts three-phase, $12 per kilowatt. Yearly operation and maintenance are taken as $5,000 for direct-current and $2,500 for alternating-current stations. The cost of locomotives shows the single-phase to cost about one-third more than the 1200-volt, direct-current type, while the 600-volt costs less than the 1200-volt machine, and the three-phase costs less than the single-phase and about one-third more than the 600-volt locomotive. The maintenance per locomotive mile of the single-phase machine is 8 cents, which is twice as much as that (4 cents) taken for the direct-current and nearly twice as much as the figure (5 cents) taken for the three-phase system.

COMPARISON OF COST OF INTERURBAN SYSTEMS.

	600 volts d. c.	1200 volts d. c.	6600 volts a. c.
First cost	$710,000	$612,500	$694,000
Fixed charges	81,200	70,600	88,400
Operation and maintenance	75,800	82,300	104,000
Annual cost	$176,000	$152,700	8172,400
Based on 1,075,000 car miles per year, additional annual charge per car mile above the cost for 1200 volts, in cents.	2.10		3.6

Assuming a definite set of conditions corresponding to an interurban road with moderate traffic—conditions which are stated to be most favorable to single-phase operation—the author compares the costs of 600-volt, direct-current, 1200-volt, direct-current, and 6600-volt, alternating-current systems.

The cost analysis shows that for these three systems the transmission line cost is the same, the substation cost of the 600-volt system about ten times, and that of the 1200-volt system about five times greater than that of the 6600-volt system; the cost of the secondary distribution system was about the same for all systems, the cost of the bonding the same for all and the cost of cars of the 6600-volt system about three times as much as the direct-current cars. Under maintenance $10,900 is charged against the single-phase system as excess track maintenance and shop costs over the direct-current systems due to the heavy cars. The totals of these analyses are given in the table herewith.

The Engineer's Duty as a Citizen.

At the Atlantic City meeting of the American Society of Mechanical Engineers, Rear-Admiral Geo. W. Melville, U. S. N., delivered an address in which, after sketching what society owes to the engineer, directs attention to some of the duties which the engineer owes to society.

In this "age of the engineer," the engineer, he says, should not rest content simply with doing the work which makes for our comfort and happiness, at the command of others, men who are lawyers or simply business men, but should himself take a vital and directing part in the administration of affairs. It may be objected that an engineer's professional work is so engrossing and exacting that he cannot become a politician in the sense that a politician is a man who gives all his time to pulling wires and filling offices; and while this is doubtless true, where it is a matter of self-interest, the engineer, like other men, can find time for this extra work.

In view of the enormously important part which the engineer plays in the life of to-day, it is incumbent upon him, more than upon most other men, to take a vital interest in the work of government and to lend his trained ability and judgment to its perfection. This does not imply that the engineer should do routine professional work for the Government without compensation, but that in the discussion of public improvements and the administration of governmental departments, he should take an active public stand to influence and guide the non-expert part of the population. It is notorious that enormous amounts of money have been squandered on great public works because they were undertaken in a way which every engineer knew must be inefficient and uneconomical. If engineers had a keen sense of duty in this respect, and would properly utilize their experience and ability through the daily press, the magazines and the reviews by public discussion and in the daily intercourse of life, as well as by impressing the truth upon our representatives in municipal and national affairs, he would accomplish an immense amount of good.

Many questions prominently before the public are peculiarly such as require engineering knowledge for their proper understanding and regulation. The word trust has come to have such a sinister meaning that it is only necessary to fasten it upon an enterprise to render it criminal in the popular estimation. Recently much has been heard about the so-called water-power trust, the charge being that all the available power sites were being grabbed so as to subject our citizens at some future time to the payment of tribute for electric power derived from them.

Engineeers know these water-powers cannot be made available except by the expenditure of large sums of money. Indeed, it would be easy to point out the fortunes that have been lost in the attempted exploitation of these supposedly lucrative natural gifts. The general public is utterly misled by statements that these power sites are obtained for nothing, the idea being that the development is a matter of small expense. Here the engineer can do a work of real benefit by disseminating correct information. Again, in the consideration of public-service corporations, the engineer knows the cost of installation and operation, and so can discuss intelligently whether rates are fair or exorbitant, and whether capital represents real investment or water. These are problems of the greatest importance, and for their proper solution, the electorate needs training that can be given by no one else so well as by the engineer.

While engineers often show public spirit, it is mostly in cases of unusual importance and relatively infrequent. Admiral Melville said, however, that what he is pleading for is a habit of mind that will cause engineers to take an active part in all public questions, great or small, where their knowledge and experience will enable them to contribute to the common good.

We have often heard engineers complain that the profession did not receive due praise and credit for its splendid work. This is true enough, but is the reason not very largely because the engineer hitherto has been content to do the work and then fade into the background, leaving the talking and the management to the lawyer and the politician? With the advance of technical education, engineers are more and more becoming the high officials of our large corporations. It is to these men, whose talents and trained ability have made them the leaders in manufacturing and in business, that the country has the right to look for leaders in the affairs of government; and not until the engineer of all grades has done his part toward the promotion of the highest efficiency of the Government can he truly say that he is, in the fullest sense of the term, a good citizen of the Republic.

Association of Railway Telegraph Superintendents.

The twenty-ninth annual convention of the Association of Railway Telegraph Superintendents was held in the Hotel Alexandria, Los Angeles, Cal., on June 20-24, inclusive. Mr. Joseph Scott, president of the Chamber of Commerce of Los Angeles, welcomed the visitors on Monday, June 20. The response was made by Mr. E. P. Griffith (Erie Railroad), Jersey City, N. J. Vice-President I. T. Dyer (of the San Pedro, Los Angeles & Salt Lake Railroad), of Los Angeles, presided in the absence of Mr. John L. Davis (Chicago & Eastern Illinois), of Chicago. Mr. Dyer was also chairman of the entertainment committee. Mr. P. W. Drew, of Chicago, the secretary of the association, was also unable to be present, and his place was filled temporarily by Mr. F. H. Van Etten, of Chicago. There is unusual activity in the telegraph departments of the various railroads, due to construction work, and many busy officials could not leave their offices. The attendance at the convention was about 75.

At the first day's session Mr. W. F. Williams (Seaboard Air Line), Portsmouth, Va., read a paper on "Train Blocking by Telephone," and this was followed by a paper by Mr. H. P. Ryner, of the Hoeschen Signal Company, whose subject was "Automatic Block and Highway Crossing Signaling." Other papers presented were on "Wireless Telegraphy," by Mr. William Maver, Jr.; "Education for Efficient Railroad Service," by Mr. D. C. Buell (Union Pacific); "Protecting Telephone Lines from Lightning and Other Disturbances," by Mr. M. E. Launbranch, of the United States Electric Company; "Telephone Train Dispatching," by Mr. E. E. Dildine (Northern Pacific); "Testing of Telegraph and Telephone Circuits," by Mr. V. E. Kissinger (Chicago, Burlington & Quincy), and "Telephoning to and from Trains," by Mr. E. P. Griffith (Erie).

Officers were elected as follows: President, I. T. Dyer (San Pedro, Los Angeles & Salt Lake), Los Angeles, Cal.; first vice-president, John B. Sheldon (Union Pacific), Omaha, Neb.; second vice-president, William Bennett (Chicago & Northwestern), Chicago; secretary and treasurer, P. W. Drew (Minneapolis, St. Paul & Sault Ste. Marie), Chicago. Boston was selected as the next place of meeting. An interesting feature of the closing session was the presentation of a gold watch, suitably inscribed, to Miss Adrienne E. Dyer, the 17-year-old daughter of the new president, who is known as the "daughter of the association."

A varied and attractive program of entertainments was presented. In the banquet hall at the hotel a number of new appliances interesting to railway telegraph superintendents were shown by manufacturers.

The Annual Convention of the A. I. E. E.

Almost ideal conditions as to location, temperature and weather surrounded the American Institute of Electrical Engineers during its annual convention held at Hotel Waumbek from June 28 to July 1. While persons in the cities were experiencing disagreeable hot weather, those who were present at the convention were enjoying the delightful cool breezes of the White Mountains. With a technical program containing only 20 items, it was possible to confine the presentation and discussion of papers to four meetings and devote the remaining time of the four days to entertainment features of a social or athletic nature. A trip to Mount Washington, which required from early morning until late in the afternoon on Thursday, furnished recreation for most of the members and guests on that day. Almost continuously the golf links and tennis courts were being used by the devotees of the corresponding diversions, while a game of baseball between the "Ares" and "Hasbeens" furnished amusement to many on Wednesday afternoon. The dance and reception on Tuesday evening was well attended and proved a thoroughly enjoyable affair. Late Thursday afternoon Prof. V. Karapetoff, of Cornell University, gave a piano recital which represented the polished work of a master and contained no intimation of an amateurish performance. The closing feature of the convention was a dinner and discussion given by the educational committee on Friday evening. As the leading speaker during the discussion, Dr. C. P. Steinmetz outlined the defects in American methods of instruction and claimed that American colleges are institutions of teaching, whereas they should be institutions of learning. He advocated increasing the length of college instruction, raising the entrance requirements and improving the staff of instructors.

TUESDAY AFTERNOON SESSION.

The first item on the program of the technical sessions was the annual address delivered by President Stillwell, entitled "The Conservation of Water-Power." Mr. Stillwell proposed that a tax be imposed on all sources of power found upon public lands—a royalty on coal mined and a rental upon water-power. He suggested that the charge imposed upon water-powers be based upon the amount of water appropriated and the effective head resulting from the topography of the Government lands concerned.

The address was received with much enthusiasm. It was moved by Dr. C. P. Steinmetz and seconded by Mr. W. S. Lee that the paper be endorsed as expressing the attitude of the American Institute of Electrical Engineers and be called by the board of directors to the attention of the proper Government officials. This motion was carried unanimously. The address was considered by all as a source of much educational information, both for the public and the government.

Dr. A. E. Kennelly presented the report of the standards committee suggesting certain amendments to the standardization rules of the Institute. After some discussion by Prof. G. F. Sever, Mr. Gano S. Dunn and Dr. C. P. Steinmetz, it was decided to send to each member a printed list of the suggested additions and changes, so that those items meeting with the approval of the membership can be included in the next edition of the rules to be issued in the fall.

A paper describing tests made upon head-lamps used upon steam locomotives was presented by Prof. G. F. Harding, of Purdue University, and discussed by Messrs. J. B. Taylor, G. H. Stickney, H. Barker, C. P. Steinmetz, C. F. Scott, H. P. Wood and J. C. Lincoln.

A paper entitled "Carbon-Filament Lamps as Photometric Standards," by Messsrs. E. B. Rosa and G. W. Middlekauff, of the Bureau of Standards, was read by Prof. W. L. Robb as chairman of the electric lighting committee. This paper was discussed by Dr. C. P. Steinmetz and Prof. A. E. Kennelly.

Mr. A. R. Cheyney, of the Philadelphia Electric Company, read a paper entitled "The Modern Oil Switch with Special Reference to Systems of Moderate Voltage and Large Ampere Capacity," which was discussed by Messrs. P. Junkersfeld, F. W. Harris, C. W. Stone, D. B. Rushmore, C. P. Steinmetz, W. I. Donshea and V. Karapetoff.

WEDNESDAY MORNING SESSION.

Three papers dealing with the dielectric strength of oil and air were read at this session, as follows: "Disruptive Strength with Transient Voltages," by Messrs. J. L. R. Heyden and C. P. Steinmetz, of Schenectady; "The Electric Strength of Air," by Prof. J. B. Whitehead, of Baltimore, and "Dielectric Strength of Oil," by Mr. H. W. Tobey, of Pittsfield. These three papers were discussed by Messrs. D. B. Rushmore, V. Karapetoff, P. H. Thomas, A. E. Kennelly, W. H. Pratt, E. E. F. Creighton, J. C. Lincoln, C. F. Scott and R. D. Mershon.

Dr. A. E. Kennelly, of Harvard University, read a paper in which attention was called to the present confusion in text-books relating to the direction of rotation of vectors used in representing alternating-current quantities. After a conversational discussion of the paper by Messrs. L. T. Robinson, J. B. Taylor, W. W. Crawford, G. S. Dunn and D. C. Jackson it was decided to bring the matter to the attention of the International Electrotechnical Commission in order that some one direction of rotation may be standardized.

Prof. Adolph Shane, of the Iowa State College, described a method for determining the voltage regulation of transformers under load conditions by the use of a duplicate transformer and an auxiliary variable-ratio transformer. The method described was discussed by Messrs. E. A. Wagner and L. T. Robinson.

WEDNESDAY EVENING SESSION.

Telegraphy and telephony were represented at the convention by two papers, namely, "American Telegraph Engineering; Notes in History and Practice," by Messrs. W. Maver and D. McNicol, and "Telephone Engineering Around the Golden Gate," by Mr. A. B. Smith. These papers were discussed by Messrs. R. W. Pope, J. B. Taylor, G. S. Dunn and W. B. Hale.

Mr. F. G. Gasche, of the United States Steel Corporation, read a paper giving a mathematical analysis of the interaction of flywheels and motors when driving roll trains by induction motors. The discussion was participated in by Messrs. C. P. Steinmetz, C. F. Scott and G. S. Dunn.

FRIDAY MORNING SESSION.

Four papers dealing with electric railway subjects were presented at the Friday morning session, as follows: "Electric Locomotive Design," by Messrs. N. W. Storer and G. M. Eaton; "A Method of Determining the Adequacy of an Electric Railway System," by Mr. R. W. Harris; Power Economy in Electric Railway Operation—Coasting Clock Tests on the Manhattan Elevated Railway," by Mr. H. S. Putnam and "Economy in Car Operation," by Mr. Cyril J. Hopkins. These papers were discussed by Messrs. W. McClellan, A. F. Batchelder, F. J. Sprague, A. H. Armstrong, E. G. Reed, J. B. Taylor, L. B. Stillwell and G. H. Hill.

A paper by Messrs. C. H. Sharp and W. W. Crawford, of the Electrical Testing Laboratories, New York, entitled "Some Recent Developments in Exact Alternating-Current Measurements" was discussed by Messrs. V. Karapetoff, L. T. Robinson, W. H. Pratt and C. P. Steinmetz.

SECTIONS ACTIVITY.

At a meeting of the sections' delegates, held Thursday evening, President Stillwell outlined the policies of the administration with especial reference to the work of the sections. He stated that the activity of the Institute along technical lines has been maintained and broadened by the formation of technical committees, of which there are now six, namely, telegraph and telephony, industrial power, high-tension, electric lighting, railway and educational. Another important change has been the authorization of the sections to hold local meetings of the Institute having equal standing with the meetings held in New York. Meetings of this kind have been held in Boston, San Francisco and Charlotte, and much good has resulted therefrom. During the year the secretary of the Institute visited many of the sections and branches throughout the whole of the United States, making for this purpose a trip covering 17,000

miles. President Stillwell expressed the need for a code of ethics for electrical engineers, outlining in this connection the unsatisfactory condition surrounding the independent consulting electrical engineer who must compete with the large manufacturing companies, which give consulting services without direct charge therefor. He called attention to the unprofessional conduct of unnamed electrical engineers and stated that the expulsion of one or two of its members would be of benefit to the Institute.

Upon being introduced by the retiring president, President-elect D. C. Jackson said that the activity and influence of the sections had been enormously increased during President Stillwell's administration. He contended that the growth of the Institute, both in numbers and influence, demands the maintenance of both central headquarters and a central control. He entered a plea for hearty co-operation of the membership through the sections during his term of office and for the future for the distribution of good from each member to the whole membership.

In the absence of Mr. P. M. Lincoln, the chairman of the sections committee, the sections meeting was presided over by Past-president C. F. Scott, whom President Stillwell introduced as the father of the sections. The following delegates, being called upon, reported the conditions of their sections and made suggestions as to the needs of the sections: Messrs. M. C. Beebe, Madison, Wis.; E. B. Bush, Minneapolis, Minn.; J. M. Bryant, Urbana, Ill.; W. A. Hillebrand, San Francisco, Cal.; G. A. Hoadley, Philadelphia, Pa.; A. S. Langsdorf, St. Louis, Mo.; A. A. Miller, Seattle, Wash.; E. L. Nichols, Ithaca, N. Y.; W. H. Powell, Milwaukee, Wis.; H. B. Stabler, Washington, D. C.; H. W. Tobey, Pittsfield, Mass.; E. A. Wagner, Fort Wayne, Ind.; H. R. Wakeman, Portland, Ore.; H. L. Wallaw, Cleveland, Ohio; J. B. Whitehead, Baltimore, Md.; H. P. Wood, Atlanta, Ga.; W. E. Reed, Pittsburgh, Pa.; W. B. Hale, Mexico City, Mexico; E. N. Lake, Chicago, Ill.; J. F. Vaughan, Boston, Mass., and C. P. Steinmetz, Schenectady, N. Y. As a result of the discussion by the delegates it was decided to suggest to the incoming administration the formation of a subcommittee to the sections committee to be composed by members selected by the sections themselves. It was also suggested that the university branches should be allowed to send representatives to the next annual convention. In order to facilitate the co-operative work of the sections three committees to determine upon the policies of the sections were appointed, each consisting of three members, as follows: Messrs. Wood, Wagner and Lake; Messrs. Nichols, Hillebrand and Hale, and Messrs. Reed, Langsdorf and Tobey. It was decided that the sections delegates should meet on the first day of the next annual convention in order to perform satisfactorily the numerous duties devolving upon them at that time.

Summer Convention of Wisconsin Electrical Association.

While the attendance was not large, and extremely warm weather was encountered, the summer convention of the Wisconsin Electrical Association, at Oshkosh, Wis., on June 28 and 29, well repaid those who attended, owing to the practical nature of the discussions. There was no formal program, and no papers were prepared in advance. Two sessions were held, and the principal subject for discussion was rates, both for electric railways and electric-service plants. The meetings were held at the handsome house of the Oshkosh Yacht Club, and the Wisconsin Electric Railway Company placed special cars at the disposal of the visitors. The president of the association, Mr. Clement C. Smith, of Milwaukee, was unable to be present, owing to illness, and Mr. Irving P. Lord, of Waupaca, vice-president, occupied the chair.

THE ELECTRIC-RAILWAY RATE SITUATION.

The first speaker was Mr. C. N. Duffy, auditor of the Milwaukee Electric Railway & Light Company. He referred to the effort of the city of Milwaukee to compel the company to carry people on the local street-railway system for 3 cents each. At present six tickets are sold for 25 cents. The question has been argued exhaustively, and it now rests with the Wisconsin Railroad Commission to decide the matter on the evidence submitted.

Turning to Massachusetts, it was remarked that if the companies in that State had not made their rates too low there would be no necessity of raising them. The same observation applies to Oshkosh, Wis., where the interurban company has asked the State commission for an increase of rates.

RATES FOR ELECTRIC LIGHT AND POWER.

Considering rates for electricity sold for lamps and motors, Mr. Duffy said that this subject was also very important. Companies, or departments of companies, ought to be just as careful in putting out a schedule of rates for supplying electric service as in making rates for carrying passengers. The speaker believes in a liberal and flexible schedule, and referred to the comparatively simple scale of rates in use in Milwaukee, where the price for electricity used for lighting varies from 12 cents to 4 cents a kw-hour, depending on consumption, and the rate for electricity used for motors varies from 8 cents to 3 cents per kw-hour.

However, the Milwaukee schedule is not entirely satisfactory. It does not contain adequate provisions for the long-hour user with a small installation, or for very large motor installations.

Mr. Duffy, in closing his instructive address, warmly advocated a more intense development of the business, as he styled it, and he said that a special effort in this direction would do more toward the establishment of equitable rates and toward securing harmonious relations with customers than almost any other improvement in the business that could be mentioned.

RAILWAY TESTIMONY FROM MANITOWOC.

Mr. Thomas Higgins, president of the Manitowoc & Northern Traction Company, of Manitowoc, Wis., agreed with Mr. Duffy that a mistake was often made in the early days of electric railroading in establishing too low rates on interurban lines.

Commenting on the general situation, Mr. Lord said there was something like a mania for reducing rates, both for electric service and in the electric-railway business. The people sometimes clamor for reduction; public-utility companies are good targets, and too often they give way to the pressure of the public. In this rate situation, the companies should be very careful, not arrogant or grasping, but safe. The holders of the securities have a right to expect payment in full. This expectation cannot be realized unless there is an adjustment of rates on a policy involving 100 cents on the dollar.

RESIDENCE LIGHTING.

Mr. W. H. Winslow, general manager of the Superior Water, Light & Power Company, of Superior, Wis., gave a thoughtful talk based on his study of the problem of rates for residence lighting. He began by saying that the tungsten lamps have supplanted the ordinary carbon lamps for the use of commercial customers.

Residence lighting is barely remunerative at the present rates. Hence the companies are approaching a crisis. Shall they push the tungsten lamps for residence lighting, and can they do so at present rates? As lamp efficiencies go up, rates per kw-hour must go up, apparently, to keep up the revenue.

In view of the impending introduction of tungstens for residence lighting, Mr. Winslow believes that the companies must put their rates on a basis where better lamp efficiencies will mean a reduction in central-station revenue not greatly in excess of the corresponding reduction in central-station expenses. He spoke of a new residence lighting rate which he has devised and is seriously considering for introduction in the city of Superior. It consists of three elements: First, a "consumer charge" of, say, 40 cents a month; second, a "capacity charge" of, say, 10 cents a room a month for the area lighted; third, a kw-hour charge of, say, 3 cents, excluding renewals, and 3½ cents, including renewals. The "consumer charge" includes the meter cost for each customer. The plan

will make the customer feel free to put in convenience lamps, which may not be used twice a year, and the tendency should be to encourage the liberal use of electric light, and also to encourage the introduction of other electrical devices, like flat-irons, heating-pads, electric cooking devices, etc. However, there may be objection to the introduction of this proposed rate schedule on the part of some small residence customers. As an alternative, to meet this objection to the "area rate" suggested, Mr. Winslow proposes a controlled flat rate of 1 cent per month per watt of the maximum allowed by the indicator installed. If this rate is chosen, it is proposed to install 25-watt tungsten lamps with a maximum consumption of perhaps 300 watts.

The "area rate," or capacity-charge rate, has not been presented to the State commission, but the speaker is of the opinion that the commission will endorse it. The proposed capacity-charge plan would increase the total revenue of the company only slightly; but it would mean a readjustment of rates so that all customers would be paying customers. In concluding, Mr. Winslow said that the present rate of 10 cents a kw-hour for electricity, so widely made by central-station companies, is almost a crime when considered in connection with residence lighting. Ten cents a kw-hour is absurdly low for some customers, and absurdly high for others.

Mr. Duffy spoke in favor of a demand charge. The rate should be so much for the first 50 kw-hours, so much for the next 50, and so on. This principle can be applied to small consumers as well as to large ones. Mr. Duffy remarked that the "room assessment" plan, so to speak, outlined by Mr. Winslow, prevails, in principle, in Detroit.

Mr. Francis A. Vaughn, consulting engineer, Milwaukee, formerly with the Milwaukee company, spoke of the effort to work out an equitable rate in that city. He said that the really equitable rate for residence customers was found to be from 20 cents to 24 cents a kw-hour. He said also that it was hard to place the small-hour customer on an equitable basis. He spoke furthermore of an investigation he has made into the electric lighting rates in towns of less than 6000 population in Wisconsin. Mr. Vaughn has found that there is absolutely no uniformity in the making of rates in these small towns. Decimal prices, such as 10 cents a kw-hour, $1 minimum and 25 cents a month meter rental, seem to be particularly popular, possibly because of their convenience in reckoning. He believed it possible that new small central stations built at the present time might use straight tungsten-lamp equipment, eliminating the carbon lamp entirely. It might be possible in that case to establish a system of rates for residence lighting from the beginning that would be satisfactory both to the company and to the customer.

Mr. H. C. Sterling, superintendent of the municipal plant at New London, Wis., told of his efforts for the establishment of a sliding scale in that city. The authorities, however, insisted on a flat 9-cent rate.

Mr. Winslow, referring again to his proposed capacity charge rate, explained that customers could use irons, heating appliances, etc., as much as they wanted to without increasing their area rate for rooms lighted.

In answer to a question from Mr. Duffy, Mr. Sterling said that the New London municipal plant showed a profit, if depreciation and taxes were disregarded.

Mr. H. G. D. Nutting, manager of the municipal light and water plant at Fort Atkinson, outlined briefly a tentative system of rates for electric lighting, which he has planned out on a theoretical basis. This proposed rate includes, first, a service charge, and, second, a demand charge, this demand charge being divided into two parts—a light-load demand and a heavy-load demand; third, there should be a kw-hour charge, which should not much more than cover the cost of actual power-house operation. Mr. Nutting told how to determine these various charges. The demand should not be based on a proportion of the connected load; this method is unscientific and unsatisfactory, in the speaker's judgment. Mr. Nutting also contended that the same rate should be made, regardless of the use to which the electricity is to be put. The central-station company is selling kw-hours plus service. In the rates which Mr. Nutting has particularly worked out on a theoretical basis the great question is to determine the demand charge. His method of determining different charges is to imagine various hypothetical plants necessary to supply the particular demand.

Mr. John S. Allen, of Lake Geneva, said that he has two convictions on the rate problem. The first is that the central-station company should not rush into reduced rates unless it is very sure it is justified in doing so. The second proposition on which Mr. Allen laid emphasis was that rates should be simplified. The speaker also, in a few words, explained how he has a heavy summer load in Lake Geneva, which is a well-known summer resort. The load curve is very even from June 1 to Dec. 1.

Mr. Lord said that his company's rate in Waupaca was mostly 10 cents a kw-hour, but 15 cents was charged on installations in such places as churches, opera house and blacksmith shops. An 8-cent rate was made to saloon keepers, hotel owners and other large long-hour customers. A meter rental of 25 cents to 50 cents a month is charged. Objection is made by some customers to this meter rental, and Mr. Lord has secured the approval of the State Railroad Commission to a rate of 20 cents a kw-hour for inconstant customers, with a discount of 25 per cent to those who come to the office of the company and pay their bills before the 10th of the month. All customers, except a few irregular consumers mentioned above, are on a 15-cent rate, with the privilege of the following special rates on yearly contract: First 10 kw-hours, 12½ cents; next 90 kw-hours, 10 cents; second 100 kw-hours, 9 cents; next 200 kw-hours, 8 cents; next 300 kw-hours, 7 cents; thereafter, 6 cents a kw-hour. Under this schedule the minimum monthly charge has been reduced from $1.25 to 75 cents. Mr. Lord's practical and shrewd way of explaining his new schedule was appreciated by his hearers.

INCREASE IN INTERURBAN RATES NEAR OSHKOSH.

Mr. J. P. Pulliam, of Oshkosh, manager of the Wisconsin Electric Railway Company, told how his company had raised its interurban railway rates within the last few months. The company operates several interurban lines. One of them, between Oshkosh and Neenah, is 15 miles long. The rate of fare has fluctuated rather curiously. Originally it was 20 cents, then it was increased to 25 cents, then decreased to 20 and recently has been again increased to 25. With the increased rate, the actual amount of traffic has shown increase also. The line from Oshkosh to Fond du Lac is 18 miles long, and the rate here has been raised from 30 cents to 35 cents. The rate of fare on the line to Omro has also been increased. In every instance the traffic has increased, following the increase in rate of fare. In Oshkosh there is a straight 5-cent fare, with universal transfers. A workingman's rate of 3 cents is made between the hours of 6 a. m. and 7 a. m. and 6 p. m. and 7 p. m. The local conditions are such that the street railway system is badly laid out, and the rate of fare should be 6 cents, or, really, 7. In Fond du Lac the conditions are such that the company can make a fair profit at a 5-cent fare.

AFFILIATION WITH NATIONAL ELECTRIC LIGHT ASSOCIATION.

From the committee appointed at the convention in Milwaukee last January to consider the subject of possible affiliation with the National Electric Light Association, Mr. L. L. Tessier, of De Pere, asked for further time to consider the subject, and at his suggestion the matter went over until the convention of next January. Later a letter was read from Mr. W. S. Putnam, of Menominee, addressed to President C. C. Smith, of the association and written at the instance of Mr. Korst, chairman of the committee, in which Mr. Putnam gave it as his opinion that the proposed affiliation was not advisable. He mentioned the fact that it would be necessary to eliminate

from the association all men connected with the municipal plants, to which he was opposed. The financial objection was also a strong one, as apparently the Wisconsin association would have to raise about twice as much money as at present in order to carry on its own work and to pay its dues to the national association. Furthermore, there was the question of combined railway and lighting companies to be considered, but as the national association is not a railway association, that question, while it might be satisfactorily settled, would cause some difficulty.

BUSINESS AND ENTERTAINMENT FEATURES.

After adjournment on Tuesday afternoon, some of the delegates enjoyed the bathing facilities provided. In the evening there was an enjoyable open-air concert at Electric Park, the Wisconsin Electric Railway Company supplying a special car for the trip and making all other arrangements.

At the Wednesday morning session an invitation was received from Mr. William Wallen, manager of the Oshkosh Gas Light Company, to inspect the Oshkosh central-station which this company owns.

Mr. Lord alluded pleasantly to the retirement of Mr. John H. Harding, of La Porte, Ind., an old member of the Northwestern association, who has sold out his electric-lighting business and is taking a trip around the world.

Vice-president Lord and Secretary Allen brought up the question of the payment of dues. The dues of active paying members are 1/20 of 1 per cent of the gross business of the preceding year, or of the electric light, power and railway departments of joint companies. There was a general discussion on the scope of the association. It was pointed out that its educational work is very important. It should educate the people and the legislators of the State on the real conditions of the electric light and railway business. Mr. Ernest Gonzenbach, of Sheboygan, moved that a pamphlet be prepared, giving the constitution and by-laws and a list of members of the association, together with other information about the organization, to be printed for general distribution. This motion was adopted.

SERVING TWO OR MORE BUILDINGS FROM ONE METER.

Mr. P. E. Cowles, of Fond du Lac, told of some conditions in that city. He particularly brought up the question: "How far does a service extend on a consumer's premises?" He told of one man who installed electric service in a shoeshop, with one meter, of course. This man now has three buildings, all getting energy through one meter. These buildings are on the same lot, or at any rate adjoining one another, simply with air spaces between. This customer has now another building across the street, and he wants to add that building to the same service with the one meter. The company objects to this, and it is a question how far it shall go in extending service from one meter.

Mr. Lord told of the case of the court house and jail in one square in Waupaca. He presented two contracts to the county clerk, one for each building, but the latter in return offered one contract for the two. The matter was referred to the State commission, which decided that the two buildings were distinct, and that a meter was required for each one. A house and barn on one lot, however, do not come within this classification, according to the commission, and can be served from one meter. Mr. Gonzenbach remarked that the Fond du Lac and Waupaca cases illustrated the weakness of a sliding scale based exclusively on energy used. He believes very thoroughly in the Doherty rate system.

STREET LIGHTING.

Considerable time was taken up at the Wednesday session by a discussion in relation to the manner of charging for street lighting. Mr. Lord cited the case of one Wisconsin city where the company furnished the electricity only, instead of getting paid so much a lamp. In this case the city took care of the street lighting and installed and maintained the poles, wires, lamps, etc. The company found this a very satisfactory method, being paid on a kw-hour basis for the electricity furnished, and being relieved from all trouble for maintenance.

Mr. W. B. Jackson, consulting engineer, Chicago, is opposed to the plan adopted by the company to which Mr. Lord referred. He said that there is no argument in favor of the city owning poles and wires for street lighting where the company supplying the electricity for that street lighting is also engaged in general commercial service.

Mr. Lord said that the complaints of city authorities in relation to outages, etc., were sometimes annoying. He is rather in favor of selling electricity for street lighting on a kw-hour basis, still, however. owning the poles, wires, lamps, etc., and maintaining them.

Mr. Gonzenbach brought up the subject of establishing standards for lamps for street lighting. He said that many places in Wisconsin still operate under the old plan of providing so many "1200"-cp or "2000"-cp arc lamps. In some cases it appears the word "nominal" is not inserted in the contract, as is usually the case.

CONCLUDING BUSINESS.

Secretary Allen said that his office receives many requests for information, and he might undertake to furnish the members the important rulings of the State Railroad Commission if desired. The secretary might also establish a sort of employment exchange, bringing unengaged men and open positions together.

Mr. Allen also mentioned the fact that the Madison Gas & Electric Company, of Madison, Wis., has been most helpful to the association in days past, and that it would be an act of simple justice for the association to show its appreciation in some maner. On motion, the matter was made a special order for the annual convention to be held in Milwaukee next January.

The thanks of the association were extended to the Wisconsin Electric Railway Company, and particularly to Mr. Pulliam, of that company; the Oshkosh Gas Light Company, and particularly to Mr. Wallen of that company, and also to the Oshkosh Yacht Club for extending the courtesies of its beautiful building.

Meeting of the S. P. E. E.

The eighteenth annual meeting of the Society for the Promotion of Engineering Education was held at the University of Wisconsin on June 23, 24 and 25. The attendance was the largest in the history of the society, being equalt to 20 per cent of the number of members as shown by the last membership list. One hundred and fifteen teachers and practitioners were elected to membership at the meeting. The meeting was largely attended by representative members, including the deans or directors of many of the important technical schools and a few college presidents. A number of heads of departments and several prominent non-teaching engineers were in attendance. The success of the meeting demonstrated that it is now possible to hold meetings of this society practically without reference to those of other technical societies, and that the Western members are numerous enough to insure the success of a meeting 1000 miles from New York.

The officers elected for the coming year are: President, Prof. A. N. Talbot, professor of municipal and sanitary engineering, University of Illinois; vice-presidents, Prof. William Kent, consulting mechanical engineer, and Prof. M. S. Ketchum, dean of the College of Engineering, University of Colorado; secretary, Prof. H. H. Norris, head of the department of electrical engineering, Cornell University, and treasurer, Mr. W. E. Wiley, publisher, New York City.

The Madison meeting consisted of five sessions for the reading and discussion of reports and papers. In addition the council held three meetings. The principal interest centered in the reports of three committees; namely, those on entrance requirements, on engineering degrees and on the teaching of

mathematics to engineering students. The committee on technical books for libraries also reported by title. The reports of the first-named three committees were printed in full in advance of the meeting. In addition to the reports a number of excellent papers were presented and discussed. Before describing the reports in detail, a few of the more important papers will be mentioned.

Prof. G. C. Shaad, of the electrical engineering department of the University of Kansas, and W. T. Magruder, of the mechanical engineering department of the Ohio State University, took up, in independent papers, the matter of inspection trips for technical students. Such trips have become, in many institutions, an important feature in technical instruction. Professor Shaad, when at the Massachusetts Institute of Technology, had charge of a course in which generating and manufacturing plants were regularly and systematically visited. His experience has shown that the advantages of such trips are "to furnish inspiration to the students and to allow them to become acquainted by actual observation with the large variety and the great magnitude of modern public-service enterprises and industrial establishments; to become more or less familiar with the details of construction, operation and methods of manufacture of machines, or the preparation of materials with which they may have to do in their advanced school work and after graduation; to furnish material for practice in the writing of technical reports, the preparation of descriptive reports forming excellent training along this line. Engineers in responsible charge of public-service or manufacturing plants are always willing to co-operate with the teachers in this work. The Ohio State University, during the past spring, conducted an extensive and well-planned trip under the general direction of Professor Magruder. A feature of this undertaking was the preparation of a booklet giving every detail of the proposed trip, with descriptions of the plants to be visited. Copies of this booklet were sent to the members of the Society for the Promotion of Engineering Education several weeks before the Madison meeting in preparation for the discussion of Professor Magruder's paper. In the paper were described the actual details of the trip, which were handled in a business-like manner. As the trip is required of all engineering students, the party is a large one, and special concessions were obtained in transportation and accommodation. The description of this trip and the outline given by Professor Shaad will be stimulating and suggestive to the faculties of other technical schools.

The society this year took up an unusual but important topic, namely, technical instruction in foreign countries. Such work in Germany was discussed in papers by Dean G. H. Shepard, of Syracuse University, and Mr. Frank Koester, consulting engineer. Dean Shepard spent last summer in an inspection of leading technical universities in Germany, and he made many interesting observations. In general, he concludes that the opportunity for the student to do advanced work is greater in Germany than in this country. Further, the teacher has better facilities for outside practice with resulting reflex influence upon instruction. The faculties are larger in proportion to the number of students, giving each student a better opportunity to come in contact with his instructors. The concentration of instruction in a few large, state-supported institutions makes possible well-equipped laboratories and elaborate lecture-room equipment. On the whole, however, the speaker was impressed more by the similarities than by the differences between German and American practice in technical instruction. Mr. Koester discussed in detail the courses of instruction in technical universities, and he also analyzed the differences between American and German engineers. He pointed out certain superiorities of the latter over the former and explained the reasons for these. The last paper in this series was by Prof. W. H. Adams, of the Imperial Pei Yang University, Tientsin, China. He reported on the work being done by that university, and showed that while technical instruction is new in China, progress is being made.

In Dean Shepard's paper mention was made of the close connection between engineering practice and technical instruction in Germany. That this co-operation may exist in this country was illustrated by the description of the work done for the Wisconsin Railroad and Tax Commissions by members of the faculty of the University of Wisconsin. Profs. W. D. Pence, J. G. D. Mack and C. P. Burgess outlined, in three brief papers, the work which they and their respective departments have been engaged in for several years. They are really a board of consulting engineers for the state commissions. As a result the state gets first-class engineering work on all public utilities, the teachers earn a fair compensation in addition to their salaries, and the instruction is improved by the close contact between the teachers and engineering practice.

The remaining papers presented at the meeting dealt with various topics, such as clearness and accuracy in composition, character training, recent progress in co-operative technical education, etc.

An experiment in the program of the Madison meeting was made in devoting some time to symposiums on efficiency in technical instruction, and on engineering mathematics with particular reference to calculus. Circular letters were sent by the president to the members of the society some weeks before the meeting requesting their co-operation, and asking a number of leading questions. The response to these was very general, and many practical suggestions were brought out. While the lengthening of the engineering course is being seriously considered by many schools, the more efficient use of time and facilities in the present courses deserves careful study. The results of the discussions comprising these symposiums should, therefore, be useful to the members of the society.

The report of the committee on engineering degrees brought out an animated discussion. The committee was appointed to consider and report upon the practicability of simplifyng the character of degrees conferred in engineering. After securing data from nearly 100 colleges and universities the committee made an analysis of present practice in conferring degrees. It was found that, although certain tendencies exist, there is absolutely no uniformity in this matter. Taking as a basis what seems to be the most important tendencies, the committee made several recommendations, as follows:

"That a four-year engineering course should normally lead to the degree of bachelor of science, to which should be added a specifying phrase, as, for example, bachelor of science in civil engineering.

"That the completion of an undergraduate course in engineering by a bachelor of arts should normally lead to the degree of bachelor of science in engineering.

"That the completion of a second undergraduate course in engineering by a bachelor of science should normally lead to the same degree with specifications of the second branch of engineering.

"That one year of resident work in graduate engineering and scientific subjects by a bachelor of science in engineering should normally lead to the degree of master of science with the specifying phrase.

"That the degrees doctor of science and doctor of engineering should be given for not less than three years of resident work in graduate engineering and scientific subjects by a bachelor of science in engineering, or for not less than two years in case of a master of science in engineering.

"That the professional engineer degrees, C.E., M.E., etc., should be given only to graduates who present satisfactory evidence of professional work of superior quality extending over not less than three years, and who submit satisfactory thesis.

"That the same degrees, C.E., M.E., etc., may be given to engineers as honorary degrees.

"That the degree of doctor of engineering, historically an honorary degree, may properly continue to be so regarded, although it is believed that, as the work of engineering schools is extended, and the granting of degrees in course becomes

more frequent, its use as an honorary degree should diminish.

"That professional and honorary degrees should in general be different from those which are given in course."

It is evident that, if the suggestions by the committee be adopted by the institutions granting degrees, the meanings of the various degrees will become more uniform.

The report of the committee on entrance requirements gave detailed analysis of the various subjects which should be required of applicants for admission to technical schools. The standard set by the committee is high, corresponding closely to the present practice of a few schools. In the debate which followed the presentation of the report the members did not agree on the requirements in mathematics. There is a general belief that too high a requirement in this subject is detrimental to the progress of the student. The advanced mathematical subjects, such as advanced algebra and solid geometry, can be taught better in the technical school than in the high school. The report was, therefore, referred back to the committee for further investigation.

The committee on the teaching of mathematics to engineering students has on hand a task of great magnitude. The purpose of the committee is to compile a complete syllabus of all mathematical branches taught in the technical school. Teachers of engineering subjects and teachers of mathematics agree that fewer topics should be treated in the mathematical subjects and that these should be taught in such a way as to make the mathematics usable. Obviously if the committee succeeds in its purpose progress will be made in the desired direction. The fact that the teachers of mathematics are joining the society in considerable numbers indicates a desire on their part to come into closer contact with other teachers of prospective engineers. The report of the committee will be distributed to the membership in a few weeks, and it will be the subject of discussion during the coming year and at the next annual meeting.

The revised report of the committee on technical books for libraries was presented at the meeting by title. The society has had in circulation for some years a report on this subject. This report was preliminary in character and it is already far out of date, so that a revision is absolutely necessary. The revision has been in progress for two years, and it has turned out to be a task of very great difficulty. The purpose of the report is excellent, and if it can be produced in satisfactory form it will be useful not only to libraries, but to all other users of technical books. The report has now been referred to the program committee of the society, which will decide soon regarding its publication.

The society has now grown to such a size that it seems practicable to put into operation some means for keeping the members more closely in touch with each other during the year. The principal publication so far has been an annual volume of *Proceedings*, which has appeared from 8 to 11 months after the meeting. It is now proposed to issue a monthly periodical and this project was a topic of great interest at the meeting. A sample number was prepared and distributed so that the members could discuss the plan intelligently. A committee appointed early in the meeting to report on ways and means for improving the work of the society reported that, in the judgment of the committee, the publication of the proposed *Bulletin* will constitute as great an advance as is feasible for the society to undertake at this time. The project is now in the hands of the program committee and the council, and it will be decided upon in a few weeks.

As one of the most important purposes of any national society is to promote friendship among its members, an account of this meeting would not be complete without a statement of the social side of the program. An afternoon and an evening were given up to an inspection of the buildings of the University of Wisconsin and of the natural scenic beauty of the surrounding country. A luncheon was served at the neighboring golf club, after which, with his audience grouped about him in the open air, President Charles R. Van Hise, of the university, delivered an informal address on "The Conservation of our National Resources." The resident ladies also entertained in various ways the ladies of the convention. The meeting was highly successful in promoting a friendly spirit among the leaders in our principal technical schools. If it had done no more than this it was fully justified.

Wisconsin Commission News.

The Wisconsin Commission has refused to grant the application of the Darlington Electric Light & Water Power Company for an increase in its rates. The company based its claim for an increase upon the fact that the present primary rate of 8 cents per kw-hour for the first forty hours use per month gives practically no return upon the investment. A primary rate of eighteen cents per kw-hour for the first fifty hours use per month was prayed for in the application.

An appraisal of the plant was made by the commission as well as an analysis of the rather meager records of the company. At the hearing the company claimed a valuation of $37,700, which it subsequently reduced to $30,049. According to the valuation as made by the commission the cost of the plant, if reproduced new, would amount to $24,154 and, excluding certain non-operating properties, the existing value aggregates approximately $17,000. In its valuation the company claimed, among other items, a total of $20,000 capital stock. It was shown at the hearing, however, that the present owners paid but $16,000 for this stock.

The rates for pumping water and street lighting are fixed by contract with the city. When the gross earnings and operating expenses were properly distributed over the different departments, it was found that the average percentage on the investment based upon the cost of reproduction new, during the years 1908 and 1909, which was available for depreciation and return upon the investment, were as follows: Water pumping, 4.49 per cent; street lighting, 9.66 per cent; commercial lighting, 7.61 per cent; total, 7.64 per cent. These percentages are considerably higher if based upon the present plant value. It was held that this allows a liberal return upon the investment inasmuch as the excessive amount charged by the company to operation and maintenance really included renewals to the plant and would therefore reduce the allowance for depreciation.

The inspections made by the commission did not confirm the claim made by the city that the service rendered was unsatisfactory. Everything considered, the commission did not feel justified in ordering an increase in rates and the case was therefore dismissed.

The commission has authorized the Wisconsin Traction, Light, Heat & Power Company to issue $500,000 par value of 5 per cent thirty-year first-mortgage gold bonds of the denomination of $1,000 each. These bonds are to bear date of July 1, 1901 and to mature July 1, 1931. They are to be issued and sold for the purpose of reimbursing the company for expenditures made for extensions and additions to its railway and lighting system, and to provide funds for future additions to its system; for the increase of its steam power plant, and for the acquisition of additional water power. The bonds are to be sold for money only, and for not less than 75 per cent of the par value.

The New Gas Light Company of Janesville recently announced a reduction in rates amounting to from 13 to 17.8 per cent of the former charges. This voluntary reduction, which may doubtless end an action which has been before the commission for about a year, was made after conferences were had with the commission. The old rates ranged from $1.50 to $1.20, according to the quantity used per month. The new rates are $1.30 per thousand cu. ft. for the first 2000 cu. ft.; $1.15 per thousand for the next 3000 cu. ft., and $1 per thousand for all over 5000 cu. ft., with a minimum bill of 50 cents per month. This reduction is a rather radical one, but the company was willing to make it rather than to pass through long and expensive litigation with the probability of an unfavorable decision finally. The plant is one of the properties of the United Gas Improvement Company of Philadelphia.

Maryland Commission News.

At the request of the Public Service Commission, Superintendent McCuen, of the Baltimore city lighting department, will send Chief Meter Tester John Marley on a trip through the western part of the State for the purpose of examining gas meters for the commission. He will be gone not less than three or four weeks. As a result of complaints made by the traffic bureau of the Merchants and Manufacturers' Association of Baltimore, concerning the service of the Baltimore, Chesapeake & Atlantic and the Maryland, Delaware & Virginia Railway companies, the commission is conducting an investigation. The complaint says that the companies do not publish, post or distribute their rates between points in Maryland; that they require prepayment of freight on goods shipped to points where regular agents are maintained, and that both the minimum and maximum rates should be prescribed so that all companies would have the same chance of doing business. The report says that these companies keep out competition by means of raising and lowering their rates.

New York Commission News.

After hearings which have lasted over six months, the Public Service Commission of the First District has practically completed its consideration of the Third Avenue Railroad reorganization plan. At a hearing June 29 the last testimony was taken and the case summed up. An adjournment was then provided until July 6 in order that the counsel for the bondholders' reorganization committee, and for the Knickerbocker committee and the stockholders' committee, which opposed the plan, might file briefs. The commission will give immediate consideration to the plan and it is promised that a decision will be reached probably by the middle of July.

At a hearing last week by the commission upon the plan proposed by Brooklyn property holders for the construction of a rapid transit route in Nostrand Avenue, between Eastern Parkway and Sheepshead Bay, upon the assessment plan, quite a number of arguments were made by citizens favoring the project. No one appeared in opposition to the plan, and the commission has taken the matter under consideration.

The Union Railway Company, which operates the surface lines in the Bronx, has applied to the Public Service Commission for permission to extend its lines from Fordham Road and Sedgwick Avenue across the bridge at 207th Street to Amsterdam Avenue and through Emerson Street to Broadway. This extension will connect the Union Railway lines with the Third Avenue Railroad Company, of which it is a subsidiary. It will also give that section of the Bronx in the immediate neighborhood of New York University a direct outlet to the subway system. A hearing will soon be had upon the application.

The Board of Estimate and Apportionment last week adopted resolutions providing for the immediate issue of corporate stock in excess of $32,000,000 to be expended for subways and other permanent improvements in the city of New York. As the Appellate Division of the Supreme Court has already decided that the debt limit can be extended by the exemption of more than $40,000,000 of self-sustaining bonds, this issue of stock can be made available for rapid transit construction.

The Board of Estimate has directed its chief engineer to prepare a plan for the extension of Seventh Avenue, New York City, southwardly to Varick Street, and for the widening of Varick Street and its extension to West Broadway. This improvement is preliminary to the construction of a rapid transit route down Seventh Avenue and Varick Street to the Battery.

A plan was submitted to Mayor Gaynor and the Board of Estimate and Apportionment last week by Louis Stern, a prominent merchant of New York City, providing for the construction of a new avenue to be cut midway between Sixth and Seventh Avenues from Third Street to Fifty-third Street. Mr. Stern's idea is that this new avenue should be used only for the purpose of carrying the elevated railroad tracks that are now upon Sixth Avenue, his theory being that the elimination of these tracks from Sixth Avenue would relieve the north and south traffic congestion from which the city is now suffering.

The Public Service Commission, Second District, has authorized the Dansville Gas & Electric Company to isssue $10,000 in gold bonds, the proceeds to be used in payment of the cost of extensions and improvements to the company's plant at Dansville, Livingston County.

The Canisteo Gas Company, of Canisteo, Steuben County, has been authorized to issue $10,500 in bonds to be sold at not less than 85, the proceeds to be used for the discharge of obligations incurred for proper purposes of capitalization.

The Commission has authorized the Bath Electric and Gas Light Company to execute a first mortage upon all its property securing an issue of $250,000 of thirty-year 5-per cent bonds and to issue at present $150,000 of these bonds. Forty-four thousand five hundred dollars of the bonds are to be sold at not less than 80 and the proceeds used in making extensions betterments and improvements to the plant. The balance of the bonds authorized at this time are to be used to refund $100,000 of outstanding bonds and discharge bills payable in the amount of $31,990.15.

The Commission has denied the application of the Hartwick Power Company for permission to exercise franchises and operate an electric lighting plant in the village of Richfield Springs. At present the Richfield Springs Electric Light and Power Company is engaged in furnishing service to the village and the Commission deems it inadvisable to allow an additional company in that village, the territory to be served being too small to allow of the successful operation of two companies. Before denying the application of the new company, however, the Commission required a stipulation from the existing company that it would put its plant in first-class condition so as to be able to serve properly the public in that locality. The company has agreed to comply with the directions of the Commission, and an order has been made requiring the purchase and installation without delay of an engine and gas producer with necessary auxiliary piping and foundation; a new alternator; to repair and rebuild the street lighting and commercial incandescent lighting system, putting the same in first-class condition; to furnish the village upon contract thirty-six alternating-current enclosed arcs, as now located, at $59.50 per lamp per annum; lighting the village hose house gratis, and other minor necessary improvements.

Further hearings will be given this week on the application of the Niagara & Erie Power Company, Buffalo & Lake Erie Traction Company and Niagara, Lockport & Ontario Power Company for authority to issue stock and bonds by the first named corporation and for consent to transfer franchises by the latter two companies to the Niagara & Erie Company; on the application of the Livingston-Niagara Power Company for permission to begin construction of an electric plant and for the exercise of franchises; and on the application of the New York, Westchester & Boston Railway Company for approval of franchises received by that company from the municipalities through which it passes.

The Public Service Commission, Second District, has prepared and is mailing to all telephone corporations in the State a circular asking for information in relation to these corporations.

Chapter 673 of the Laws of 1910, which became a law June 25 and takes effect September 1, extends the jurisdiction of the Public Service Commission, Second District, to every telephone line which lies wholly within the State of New York and to that part within the State of New York of every telephone line which lies partly within and partly without the State of New York, and to the persons or corporations owning, leasing or operating any such telephone line.

The exception to the jurisdiction are corporations, companies, associations, joint stock associations, partnerships or persons having property actually used for the public service in the State of a value not exceeding $10,000, or which do not operate the business of affording telephonic communication for profit.

Blanks are enclosed with the circular which require an answer to the questions submitted on or before July 15. The questions asked are for the name, address and officers; towns,

villages and cities in which the companies operate; kind of corporation, whether a person, partnership, association or an incorporated corporation; the capital stock issued and outstanding, showing common and preferred stock; a statement of the outstanding bonds of the corporation or association, their date of maturity, security, and rate of interest; if exempt from the provisions of the law statement must be made of the property in the State of New York actually used for public service, including poles, wires, switchboard, office furniture and other property and the value of each; and if the property is not operated for the business of affording telephonic communication for profit, a statement of the conduct of its operation must be shown in detail.

The information which the commission has on hand indicates that there are 1106 telephone corporations in the State of New York. It is probable that considerably less than one-half will come within the jurisdiction of the commission because of the exemptions as to the companies having less than $10,000 in property or those not carrying on business for profit.

The greatest number of telephone corporations is in Steuben County, which has 119; Alleghany follows with 70; Chenango has 62; Delaware, 48; Greene, 39; Broome, 36; Albany, 34; Chautauqua, 32; New York, 31; Columbia, 28; Herkimer, 26; Tioga, 24; Otsego, 24; Wayne, 23; Oneida, 23; Schuyler, 22; Cayuga, 22; Jefferson, 22; and Essex, 20; Chemung, Erie, Madison and Orange, 19; Onondaga and Oswego, 18; Cattaraugus, Rensselaer and Schoharie, 16; Lewis, 14; Tompkins and Yates, 13; St. Lawrence, 12; Ontario, 11; Montgomery, 10; Sullivan and Warren, 9; Franklin, Seneca and Ulster, 8; Clinton, Genesee, Kings, Monroe and Wyoming, 7; Saratoga, Schenectady, and Washington, 6; Livingston, Suffolk and Westchester, 5; Fulton, Hamilton and Orleans, 3, and Putnam, 1.

The Public Service Commission, Second District, completed three years of its existence on June 30. During that time there have been submitted to the commission 4918 applications, complaints, etc. During the first three years of the existence of the Board of Railway Commissioners that body had presented to it 219 matters and during the entire 24 years and 3 months of its existence the number was 4814. The total number of cases handled by the Commission of Gas and Electricity during its existence of 11 months was 145. During the three years the commission has made 255 orders authorizing various kinds of capitalization amounting to $344,262,088. The commission held hearings on 635 days and giving a total number of 1324 public hearings. During the year ended June 30, 1908, 416 hearings were given on 195 days; during the year ended June 30, 1909, 443 hearings were held on 202 days and for the year ended June 30, 1910, 465 hearings were held on 238 days.

Massachusetts' Commission News.

The Massachusetts Railroad Commission has issued an order authorizing the Old Colony Street Railway Company to carry baggage and freight in the city of Quincy. The order specifies that no more than two freight cars shall be run at any one time, and that such service shall not be given on highways between midnight and 5 a. m.

The board has issued a finding approving the terms of purchase of the Berkshire Street Railway Company by the New York, New Haven & Hartford Railroad Company. The latter organization will proceed to extend various trolley lines in western Massachusetts, co-ordinate them with its steam service and improve the transportation conditions in the Berkshire Hills in harmony with the law recently passed by the Legislature of 1910.

The Massachusetts Gas & Electric Light Commission has announced that it will give a public hearing on July 13 at its offices in Boston in connection with a resolve passed by the Legislature of 1910 providing for an investigation by the board "of the circumstances affecting the transmission of electricity for light, heat and power upon, along, across and under the public ways, and across any waters within the commonwealth, and upon private land, and especially with respect to the transmission of electricity in bulk, and to such lines as must pass through two or more cities or towns in order to connect a source of supply with a suitable market for the electricity generated; to examine the laws relative to the location, construction, maintenance and use of lines for the transmission of electricity and the authority of the local officials and of said board with respect thereto; and to report to the next general court the result of its investigation and examination, with such recommendations as it may deem advisable." It is probable that this investigation will tend to bring out many matters of interest in connection with high-tension energy transmission and distribution in Massachusetts, and that special consideration will be given to existing or desirable relations of the commission with companies dealing in hydroelectric power, whether generated within or outside the State. The announcement of the hearing is being sent to all persons, corporations and municipal governments known to be possible parties to the investigation, and it is the intention of the commission to make a thorough study of the relations of electrical transmission to questions of public policy. Until within a few years electrical distribution in Massachusetts has been distinctly local in character. The centralization of production and service and the entrance into the field of energy transmission comparable in voltage characteristics with practice in the far West have introduced new questions of public and corporation policy for the consideration of the board and the Legislature.

The Massachusetts Railroad Commission gave a hearing on June 28 upon the petition of citizens of Cliftondale for the construction of a double-track line on Malden Street and Broadway, in Revere and Saugus, on the Boston & Northern Street Railway. Judge William E. Ludden represented the petitioners, and Bentley W. Warren, Boston, conducted the case for the company. Mr. Warren argued that the population of Saugus is only 8000 persons, and that the volume of traffic is too small to support the cost of building a double-track line. The company has found that there is no profit in carrying passengers from Saugus to Boston, and that the amount of local traffic originating on the line is too small to be of much value. Figures were submitted to the board showing the volume of traffic at three strategic points on the lines in question. Mr. Warren said that if any double tracking is to be done it would be better for the company to do it in case the so-called Squire's Farm Boulevard is developed. It was estimated that the cost of building a double-track line on the boulevard for a distance of 6000 ft. would be $32,444, while the cost of a corresponding double track on Malden Street, 7380 ft. long, would be $59,673. By the use of the boulevard the running time would be cut down. The company has lately put on an improved service to and from Saugus. The board took the case under advisement.

The board gave a hearing on June 29 upon the petition of citizens of Lawrence for extensions of service in the Prospect Hill district. Mr. P. Lyons conducted the petitioners' case. Interest centered on the desire of the petitioners for an extension of the Boston & Northern Street Railway down Prospect Hill, one side being served by an existing line. For the company, Mr. B. W. Warren pointed out that such an extension would not be in the interests of safety on account of the prohibitive grade, and that the labor, power and maintenance requirements would not be met by the traffic. The hearing was closed.

CURRENT NEWS AND NOTES.

International Association of Municipal Electricians.—The fifteenth annual convention of the International Association of Municipal Electricians will be held in the convention hall, Rochester, N. Y., Sept. 6-9, inclusive. Papers will be presented on "Wireless Telephone and Telegraph Systems," "Lightning Protection," "Mercury Arc and Other Rectifiers," "Relation of the Telephone to the General Organization of Fire Department Service," "Underground Work," and "Modern Police Telegraph System." Mr. Frank P. Foster, of Corning, N. Y., is secretary of the association.

Pennsylvania Electric Association.—The next convention of the Pennsylvania Electric Association (State branch of N. E. L. A.) will be held at Glen Summit Springs, Pa., Sept. 14, 15 and 16. Mr. Vanduzen Rickert, Pottsville, Pa., is secretary of the association.

Summer Joint A. I. E. E. Meeting in Chicago.—A special summer joint meeting of the Western Society of Engineers and the Chicago section of the American Institute of Electrical Engineers will be held at the rooms of the former in Chicago on the evening of July 8. Mr. W. A. Blonck, of the Institute, will deliver an illustrated lecture on "Recent European Progress in Dirigible Balloons."

Electrical Supply Jobbers' Convention.—The Electrical Supply Jobbers' Association will hold its annual convention at the Clifton Hotel, Niagara Falls, Ont., Can., July 19, 20 and 21. As this is an important gathering of men engaged in that branch of the industry and Niagara Falls is a pleasant place in which to spend a few days during July it is expected that there will be a large attendance.

A Simple Air-Cooling System.—A simple air-cooling system—not new, but timely at this season—which was recently resorted to by a Government official in his Washington office, comprises a large cake of ice in a wash-tub, against the surface of which the breeze from an electric fan is directed. The air, chilled by blowing over the frozen surface, rapidly lowers the temperature of the room and provides a simple refrigerating system when other means are not at hand.

Larger Quarters for Electrical Laboratories at Michigan University.—As the result of restricted space following the recent growth of the electrical engineering department at the University of Michigan, Ann Arbor, the motor and power machinery laboratory has been moved to the opposite end of the engineering building, near the mechanical laboratories, making larger quarters available. The telephone laboratories will remain in their former location, expanding into some of the rooms vacated by the motor laboratory. Fifty students received the degree of bachelor of science in electrical engineering at Michigan this year.

Detroit Edison Orders More 14,000-Kw Turbine Generators.—Two 14,000-kw turbine-generator sets have been ordered by the Edison Illuminating Company, of Detroit, for delivery next year to complete its Delray power house No. 2. The Edison company is now supplying 4500 kw to the Detroit United Railways, and will shortly increase this amount to 9500 kw. When the Detroit River tunnels of the Michigan Central Railroad are opened in September the Edison company will also begin the supply of energy to the 2000-kw rotary-converter substation, which will furnish 600-volt direct current for the tunnel locomotives.

Special Lighting at Detroit for Elks' Carnival.—About 30,000 incandescent lamps will be used on arches, pillars and festoons to decorate the principal business streets of Detroit during the B. P. O. E. carnival and convention, July 10 to 16. Features of the electrical display will be two large arches at downtown street intersections, one containing 2500 and the other 1500 lamps. The city of Detroit has appropriated $30,000 to carry out this public illumination, and the number of lamps used in private displays will probably equal that installed in the special street lighting. The use of about 25 powerful electric searchlights directed heavenwards is to be one of the novelties of the night illumination. The Detroit Edison Illuminating Company will co-operate with the local municipal plant by furnishing about three-fourths of the energy for the public special lighting.

Illumination of an 11-Acre Army Tournament Arena.—Considerable attention has been attracted by the illumination by flaming-arc lamps of the great arena in Chicago's lakefront Grant Park, where the United States Army tournament and maneuvers are being held, July 4-14. The inclosure, including the tiers of seats, measures 600 ft. x 800 ft., and is provided with illumination estimated equivalent to 240,000 cp, by 80 flaming-arc lamps hung at 50-ft. intervals. The installation is said to be the largest of the kind ever attempted. The arena in which the meneuvers take place measures 600 ft. x 400 ft. The lamps are suspended at a height of 35 ft., from eight 600-ft. spans, each carrying 10 lamps, between poles set outside the boundaries. Each arc is rated to give 3000 cp, and consumes 550 watts, two lamps being connected in series across the 110-volt, alternating-current mains. Electrodes, impregnated to give a brilliant yellow light, are used. The installation was erected by the construction department of the Commonwealth Edison Company, which furnishes the energy to light the lamps; it cost, complete, about $5,000.

Over a Year of Uninterrupted 110,000-Volt Operation.—The 110,000-volt, 30-cycle transmission line of the Grand Rapids-Muskegon Power Company, from Croton Falls into Grand Rapids, Mich., has now been in continuous operation since April 30, 1909, when service was temporarily interrupted by a severe sleet storm which pulled down and grounded the wires at some points, in spite of the unusually heavy construction of this line. A peculiar circumstance of the trouble at that time was the grounding of several of the jumpers around strain insulators at corner towers, by being rotated over against the cross-arms as a result of the twisting torque developed in the stranded cables by the abnormally heavy strains due to the sleet coating. For more than 14 months, now, the Grand Rapids 110,000-volt line has been operating without interruption of any kind, and although working without lightning arresters in a region where lightning discharges are especially severe, is reported to be giving less trouble than nearby transmissions of lower potentials.

"Wayside" Telephones in Detroit.—There are now over 500 "wayside" telephone stations or connection jacks connected to the lines of the Home Telephone Company, of Detroit, installed at various street corners and public places throughout the city. For use with any of these stations regular telephone subscribers of the company, on payment of 50 cents additional per month, are furnished with a pocket combination receiver and transmitter set weighing but a few ounces. The hand telephone set is fitted with a connection plug and cord, inserting which in any of the station jacks calls central so that any telephone in the city may be reached. It is said that no point within the city limits is more than one-quarter mile from a "wayside" station. As the series alternating-current arc-lamp circuits interfere with some of the police telegraph circuits, it is proposed to have Detroit's patrolmen in outlying districts use the telephone boxes for reporting. The city authorities are also considering equipping all fire apparatus with the hand sets for emergency communication with headquarters.

Court Technical Experts.—The following is quoted from a letter written by a prominent engineer who occasionally acts as a court technical expert: "It is unfortunately true that there is a prejudice against technical experts, but this is entirely the fault of those who are willing to prostitute themselves by deceiving the court. While this may be common practice among medical men, and particularly alienists, no self-respecting technical man of good standing should be guilty of such practice; or if found guilty, he should be ousted from the profession. In many technical cases it is generally possible to get at the true facts and thereby determine whether an expert has been deceiving the court or not. I have been engaged in many cases, and in almost every one of them the attorneys expected or asked nothing more of me than to state the exact facts. Most attorneys of good standing, I find, do not care to undertake cases when they do not honestly believe that the facts are on their side. I repeat that it is very unfortunate that technical witnesses are getting the same low reputation as doctors and alienists."

IRRIGATION AND ELECTRIC ENERGY.

Hydroelectric Features of Some of the Projects of the Reclamation Service.

AMONG the large number of projects undertaken by the Reclamation Service of the United States Government, organized about eight years ago for the construction of irrigation works for the reclamation of arid lands under the direction of the Secretary of the Interior, several are characterized by incidental water-power development. In these plants electricity is generated and often transmitted considerable distances for use in lighting or in the operation of motors, these motors being used for pumping, for driving machinery used during construction or for other purposes. In a few cases, however, steam generating stations have been built, under favorable circumstances, to furnish electrical energy for the operation of motors driving pumps used in irrigating works.

The work of the Reclamation Service extends into nearly all the States and Territories in the western half of the country and is of the greatest value and interest. Its main purpose is the construction and maintenance of irrigation works for the storage, diversion and development of waters for the reclamation of arid and semi-arid lands in Western States and Territories. The lands so reclaimed are subject to homestead entry. There is no charge for the land itself, but the settler must repay the Government in not more than 10 annual installments his share of the amount expended in reclaiming the land. Incidental to this work there has been considerable electrical development, carried out under the technical direction of Mr. O. H. Ensign, of Los Angeles, chief electrical engineer for the Reclamation Service. The accompanying pictures show some of the interesting electrical features of the work and brief outline descriptions of some of the reclamation projects are given herewith.

SALT RIVER PROJECT, ARIZONA.

One of the most interesting of the numerous large engineering projects on which the Reclamation Service is engaged is the Salt River project in Arizona. The source of water supply here is the Salt and Verve Rivers and wells. The irrigable area of the whole project is 240,000 acres. A large storage reservoir has been constructed on Salt River at Roosevelt, Ariz., about 70 miles northeast of Phoenix. This reservoir is controlled by the Roosevelt dam, which is one of the largest in the world, having a maximum height of 280 ft., with a length of crest of 1080 ft. A power plant has been constructed at the storage dam for generating electric energy from the stored water in the reservoir and from water delivered from a power canal heading at a diversion dam on Salt River about 18½ miles above the storage dam. Fig. 1 shows the Roosevelt dam and power house, also the transformer house and the transmission line. The output of the generating plant will be used partly for pumping water from underground

Fig. 1—Transmission Line Leaving Transformer House at Roosevelt Dam. Salt River Project, Arizona.

sources to high lands in the Gila River Indian reservation and in Salt River Valley, while the remainder will be sold for industrial purposes.

When completed the power development will amount to 4400 hp from the power canal and 3000 hp from the Roosevelt reservoir. The transmission line has been completed from Roosevelt to Phoenix, a distance of 75 miles. There are two circuits, each made up of three wires. A branch line 19 miles long, consisting of a single three-wire circuit, is taken off at a switching station located 1½ miles northeast of Mesa, and leads to the Gila River Indian reservation. Fig. 2 is a rear view of the Mesa switching station. The sub-tropical character of the vegetation will be noticed. The transmission line east of the irrigated lands is supported by towers of the four-leg type, standing on a concrete pier. In the settled portion of the valley the line is supported by tripartite poles imbedded in concrete. The three conduc-

tors of each circuit are arranged with the base of the triangle inverted.

The transformer house near the Roosevelt power house has been completed and is equipped with the necessary transformers and other apparatus to deliver the electrical energy to the transmission line at 45,000 volts. One substation is placed about eight miles south of Mesa and another one will be

Fig. 2—Rear of Switching Station Near Mesa. Salt River Project, Arizona.

located on the Gila reservation. About 10 miles of distributing circuits will be supplied from each substation. A large proportion of the electrical energy is transmitted to Phoenix and distributed by the Pacific Gas & Electric Company of that city.

Among contractors for the power plant were S. Morgan Smith Company, water-wheels; General Electric Company, electrical apparatus; U. S. Wind Engine & Pump Company, transmission line supports; B. F. Kierulff, Jr., & Company,

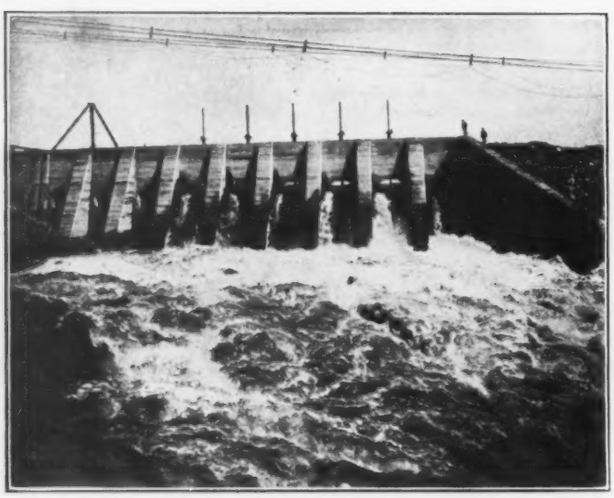


Fig. 4—Downstream View of Dam in Diversion Channel, Minidoka Dam. Minidoka Project, Idaho.

transmission line poles, and John A. Roebling's Sons Company, copper wire.

UNCOMPAHGRE VALLEY PROJECT, COLORADO.

Another large project is the Uncompahgre Valley project in the State of Colorado, utilizing the waters of the Gunnison and Uncompahgre rivers. Here an estimated total of 10,000 hp in water power may be developed. The plan is to divert the water from the canyon of Gunnison River by means of a 6-mile tunnel to supplement the flow of Uncompahgre River in the irrigation of lands in the Uncompahgre Valley. The building of various canals is included in the plan. Work is under way on this great project and a large water power will be available, the plans for the utilization of which, however, have not been completed. A temporary electric power plant has been installed.

MINIDOKA PROJECT, IDAHO.

Of a different character is the Minidoka project, utilizing the water of the Snake River, supplemented by storage, in

Fig. 3—Minidoka Dam. Minidoka Project, Idaho.

the State of Idaho. Briefly, the irrigation plan of this project provides for the diversion of the waters of Snake River for the irrigation, by gravity and pumping, of lands lying north and south of the river in Lincoln and Cassia counties. A combined storage, diversion and power dam has been constructed across Snake River about 6 miles south of Minidoka, Idaho. Electrical energy developed at the dam is utilized in pumping from the canal on the south side of the river for the irrigation of high lands, but the power and pumping plants and the

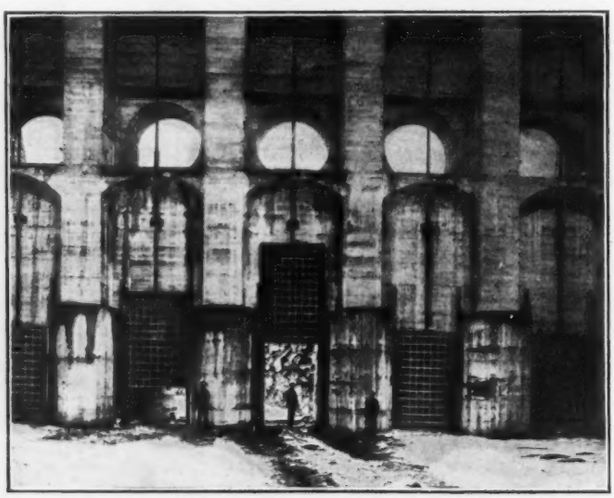


Fig. 5—Diversion Channel Dam, Upstream Face, Taken from Bottom of Channel. Minidoka Project, Idaho.

canals for distributing pumped water have not been completed.

The developed water power amounts to 1800 hp, while the estimated total is 7200 hp. The reservoir is Lake Walcott. Fig. 3 shows the Minidoka dam, looking from the spillway toward the power house. Fig. 4 is a downstream view of the unfinished dam in the diversion channel, showing the water passing through penstock openings. At the time this photograph was taken about 22,000 cu. ft. of water a second were passing through the dam. Fig. 6 is a nearer view of the uncompleted power house at the Minidoka project, while Fig. 5 is an interior view of the unfinished Minidoka power house, showing the five gates and penstock openings.

Early last year an 1800-hp turbine water-wheel and generator, a 140-hp water-wheel turbine with exciter, and a transformer were installed in the power house. About 16 miles of transmission line was built and at various pumping stations 300-hp and 600-hp motors driving centrifugal pumps were installed. Temporary wooden structures were built over the machinery. A duplication of this equipment is now under construction.

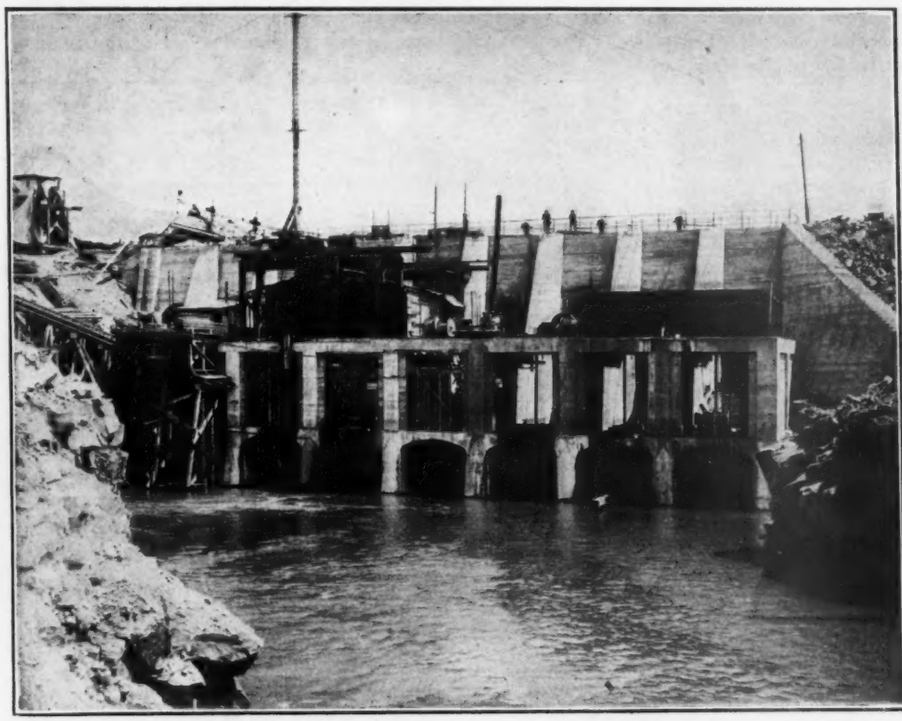


Fig. 6—Power House. Minidoka Project, Idaho.

For this project the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company supplied the electrical apparatus, while the latter company also furnished the turbines and pumps. The Niles-Bement-Pond Company furnished the cranes, the Weber Gas Engine Company gas engines, and the Standard Underground Cable Company copper wire.

GARDEN CITY PROJECT, KANSAS.

The Garden City Project, in the counties of Finney and Kearny, in the State of Kansas, is radically different in character. It was constructed to utilize by pumping the underground flow of the Arkansas River Valley. A steam power house having a rating of 600 hp in steam turbines, Fig. 8, was constructed on the main line of the Atchison, Topeka & Santa Fé Railroad at Deerfield, Kan. The building is constructed of pressed brick and concrete and contains two 300-hp steam turbines, direct connected to 6600-volt generators. The electrical energy is transmitted to 23 pumping stations which are located along a concrete-lined canal 20,000 ft. long. The pumped water is discharged into this canal. At each of three of the pumping stations the pumps are connected to 12 15-in. wells from 30 to 50 ft. deep. At the other 20 stations the pumps are connected to nine wells each. The pumps are 9 and 10-in. vertical centrifugal machines, each direct connected to a 25-hp three-phase induction motor. All of the pumping units are installed and are now in operation. Fig. 7 gives an exterior view of one of these pumping stations and also of the transmission line.

A soft-water well 247 ft. deep was drilled at the power plant for boiler feed purposes. Oil is burned for fuel and a 55,000-gal. concrete oil-storage tank was constructed. A very marked saving in the cost of fuel resulted in the change from coal to oil.

WILLISTON PROJECT, NORTH DAKOTA

The source of water supply for the Williston Project, in Williams County, N. D., is the Missouri River. The irrigation plan of the first unit of this project provides for a central steam-turbine power plant, operating pumps and generating electricity for the operation of pumping plants. Fig. 10 shows this generating station, which was not quite completed at the time the picture was taken. A series of motor-driven centrifugal pumps is operated on a barge in the Missouri River. A settling basin receives water from the barge pumping plant, and a main canal extends from the settling basin along Little Muddy Creek to the power plant. At the power plant there

Fig. 7—Substation No. 1, Main Canal and Transmission Line. Garden City Project, Kansas.

is a pumping station having electrically-driven pumps which lift water from the main canal to a high-line canal. This pumping station No. 1, as well as the power house, is shown in Fig. 10. A second pumping station with electrically driven pumps lifts water from the high-line canal to a higher canal. In the central power house there are also two sets of steam-driven pumps which lift water from the end of the main canal to a high-line canal.

The power station is conveniently located adjacent to a vein of lignite coal, from which fuel is obtained. This station also generates electrical energy which is delivered over a transmission line to the Buford-Trenton project in Williams County, N. D., where water is obtained by means of pumps on a barge in the Missouri River, in much the same manner as in the Williston project. The transmission line connecting the two projects is 28 miles long. Fig. 9 shows the Missouri River barge supporting electrically-operated pumps with discharge pipes in position. The power and pumping system for the Williston project was supplied by the D'Olier Engineering Company.

OTHER PROJECTS.

At the Klamath Project, in Oregon and California, the power development has not been determined, but electrical energy for irrigating about 15,000 acres of land which lie above the gravity canals of the project may be obtained from

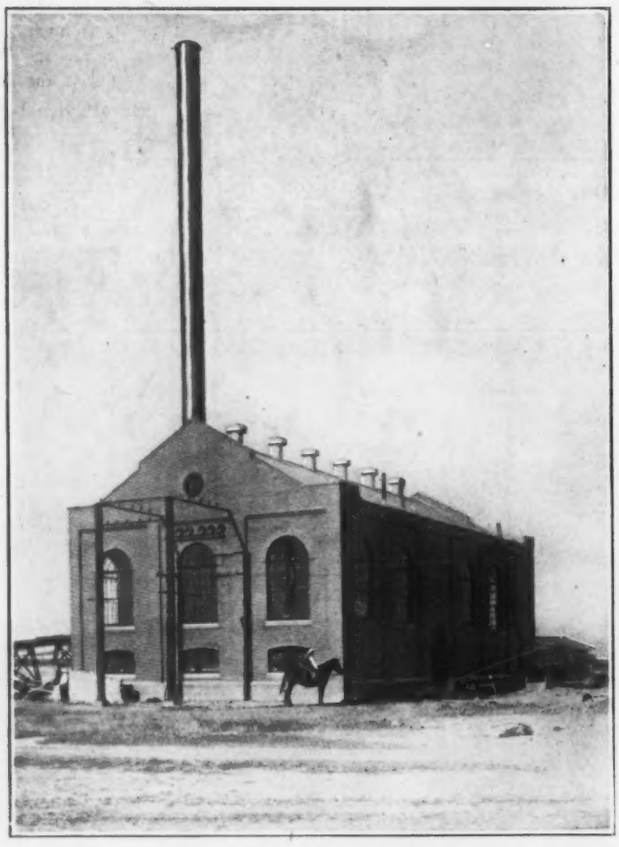


Fig. 8—Pumping Plant Power House. Garden City Project, Kansas.

the Klamath River, utilizing a drop from the main canal to the south branch canal of the project. On this project, up to June 30, 1909, a total of 64 miles of telephone line had been constructed.

The Strawberry Valley Project in Utah presents an estimated total of 3000 hp in water-power capable of development. Here the first unit of the power plant has been completed, together with a power transmission line 26½ miles long, extending to a substation at Strawberry tunnel, where all tramming and hoisting is done by electric motors. The power house contains two 450-kw generators and two 600-hp turbine water-wheels, with the necessary exciters, switchboards and accessories. Here the water-wheel apparatus comes from the Dayton Globe Iron Works Company and the electrical apparatus from the General Electric Company.

The Sunnyside unit of the Yakima Project in the State of

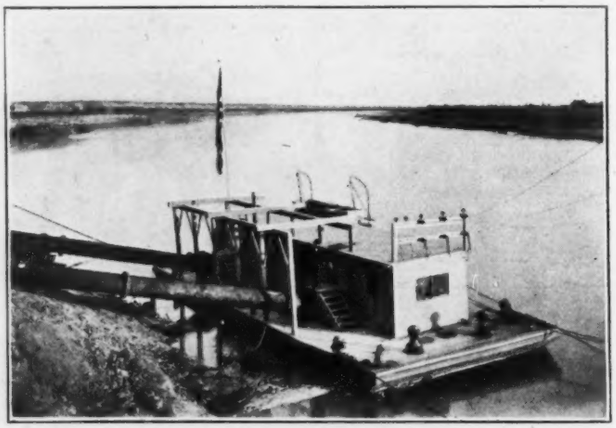


Fig. 9—Barge Bearing Pumps, Station No. 3. Williston Project, North Dakota.

Washington involves a possible power development of about 2000 hp. Power plants may be built at various drops on the canal and laterals. The water supply is that of the Yakima

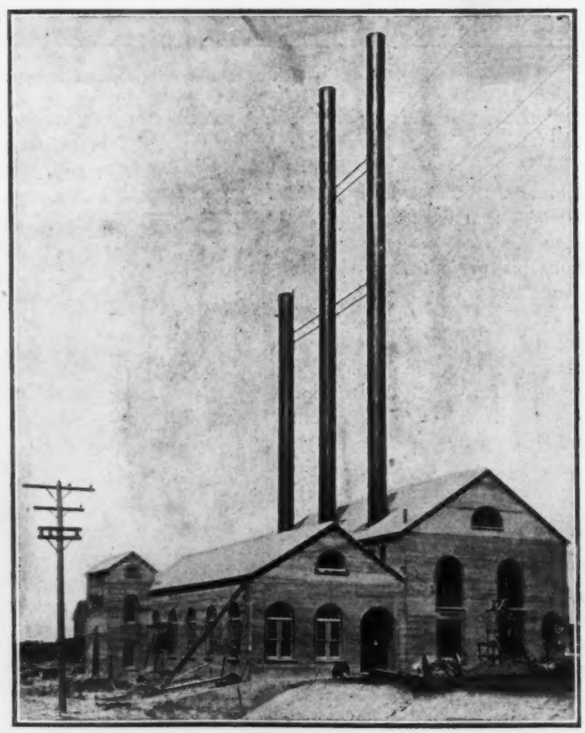


Fig. 10—Power and Pumping Station No. 1. Williston Project, North Dakota.

River near Parker, Wash., but the power development remains to be undertaken.

The Tieton unit and the Wapato unit of the Yakima Project also involve water-power possibilities, estimated at 4000 hp in the case of the former and 9000 hp for the latter, but the plans for power development have not been worked out as yet.

The Truckee-Carson Project, resulting from a dam at the outlet of Lake Tahoe, in Nevada, and the Shoshone Project, utilizing the water of the Shoshone River in Big Horn County, Wyoming, also present water-power possibilities.

ELECTRICITY IN A MODERN GAS MANUFACTURING PLANT.

ONE of the latest applications of the electric motor to novel industrial service is found in the field of illuminating gas manufacture. It is noteworthy that in the two or three most recently completed gas installations in America electricity is demonstrating its economy and effectiveness in a manner which presages a rapid extension of such service in the gas industry. At Worcester, Mass., New Haven, Conn., and Astoria, N. Y., electric motors are employed in connection with coal-handling equipment of the most advanced design, with resulting savings in labor and operating cost, which look decidedly attractive to the gas engineer. While it is too much to claim that the high rates of gas production enjoyed by the Worcester Gas Light Company per pound of coal are immediately dependent upon the mechanical driving of the equipment, there is no question that the cost of production is lowered by the apparatus now in service, which depends in the most intimate degree upon electricity for its operation. In the following article some particulars are given of the electrical installation at Worcester, which has already created a reputation among gas engineers as one of the most efficient plants in the country.

The plant of the Worcester Gas Light Company occupies a tract of land about 17 acres between Southbridge Street and Quinsigamond Avenue, and substantially one mile from the center of distribution in the city. The company naturally generates its own electricity, having ample generating facilities. The installation consists of one 150-kw, 250-volt, General Electric, direct-current generator direct-driven at 285 r.p.m. by an American-Ball angle-compound engine, and two General Electric, 150-amp, 600-volt, three-phase alternators, each direct-driven at 225 r.p.m. by an American-Ball duplex-compound engine. The alternating-current and direct-current sides of the station are tied together by a 150-kw motor-generator set, consisting of a 200-hp induction motor driving a 250-volt generator at 600 r.p.m. Two 9-kw, 125-volt, belt-driven exciters are in service on the alternating side of the plant. Steam is supplied to the engines by a plant of three 400-hp horizontal return tubular boilers, manufactured by the Stewart Boiler Works, of Worcester. An 11-panel switchboard is installed in the engine-room for the control and measurement of the electrical energy. All the alternating-current machinery operates at a frequency of 60 cycles.

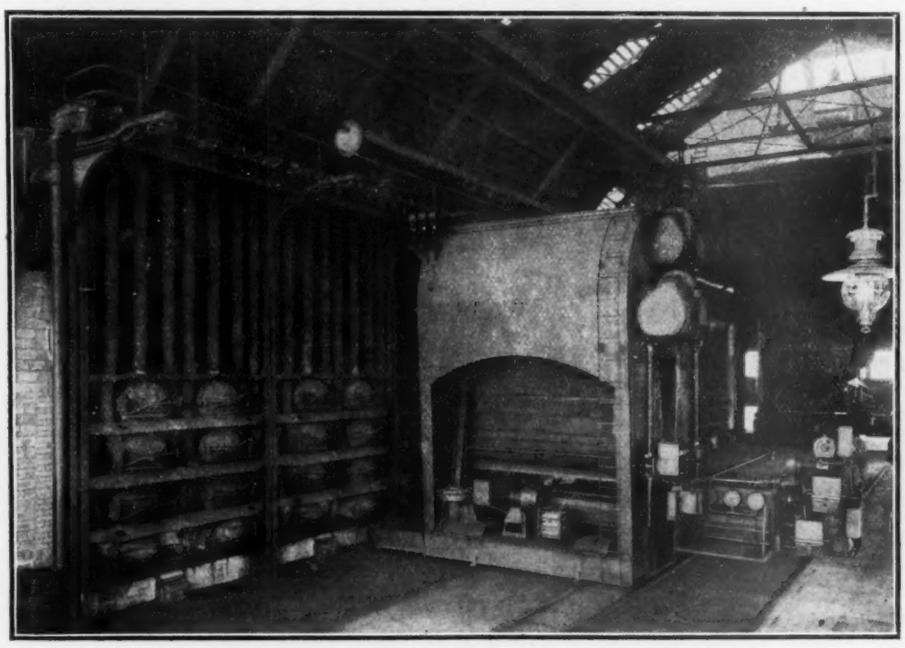


Fig. 1—Electrically-Driven Retort Charging Machine.

About 50 electric motors are in service on the property, and as a result the company is saved the losses and inconvenience which ordinarily attend the transmission of energy for varied uses over such an area by steam piping. The farthest point from the power house at which electricity is employed is about 1000 ft. distant. The demands are somewhat scattered, and include the driving of hoists and cranes, conveyor operation, running of blowers, pumps, crushers and charging equipment. The extensive use of the electric motor in these works has resulted in minimizing the labor requirements to the lowest degree consistent with reliable service to a city of about 150,000 inhabitants. The local lighting service is handled on 110-volt lines through appropriate transformers. Part of the service in the plant is operated by direct-current lines, including certain of the larger electric cranes and telphers, while the three-phase motors in the retort house are supplied with energy from the alternating generators, the potential being stepped down from about 600 volts to 220 volts.

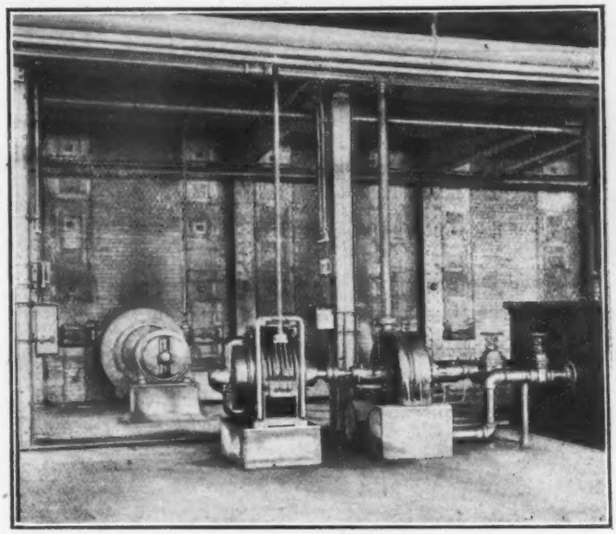


Fig. 2—Electrically-Driven Pump and Blower.

The new retort house of the company has been in operation about 20 months, and in its general design and equipment is the work of the Riter-Conley Manufacturing Company, of Pittsburgh, Pa. The house is designed for two retort stacks of 10 benches each. Coal is stored on the premises in a pocket having a capacity of 25,000 tons, the pocket being served from cars on a siding by a 1-ton Brown hoist electric crane. From the pocket, coal is passed through a crusher on its way to the retort house bunker, all the handling being by electricity. The coal bunker in the roof space of the retort house has a capacity 600 tons, and is filled from the coal-storage house by means of a trolley and electric grab bucket of the Brown-hoist type which passes over a covered bridge from the coal-storage house to the retort building. The coal is crushed by apparatus driven by a 20-hp induction motor, the largest lumps being cubes of not over 1¼-in. sides. Two 40-hp motors are employed to drive the second Brown-hoist crane, which is of 2 tons' capacity.

The present installation of retorts consists of 10 benches of eight retorts each. The retorts are 15 ft. long and are built of "Ricon" material. Double tracks are provided through the center of the retort house for the use of the charging equipment, which is of novel design, being provided with electric automatic machinery throughout. In the middle of the retort house tracks, there is installed an electrically operated turn-

Fig. 3—Coal Handling Electric Telpher.

table, with a large platform scale built into it. There are duplicate charging machines of Riter-Conley special design, Mr. Hilliard, of the above-named company, being responsible for the details of the mechanism.

All the motors in the retort house are of General Electric manufacture, and of the induction type, totally enclosed, and automatically controlled by solenoid switches. The charging machines each consist of a car mounted on four wheels and having a height of about 8 ft., length of about 7 ft., and width of about 5 ft. The machine has a pocket of 20,000 lb. coal capacity, and fuel is drawn into this pocket from the overhead bin by means of easily handled valves. A motor-operated hopper in the top of the machine carries approximately 1 ton of coal, which is dropped into a pair of scoops at such times and in such quantities as the service demands. A charge of coal of from 900 lb. to 950 lb. is ordinarily used per retort.

The scoops, loaded with coal, are pushed into the retort by electricity, the coke of the former charge being pushed out by the entering scoops. The scoops are then turned over by a motor and are withdrawn, leaving the charge very evenly distributed over the floor of the retort and also leaving it quite full of fuel. A motor is provided to elevate or depress the scoops according to the height of the retort in relation to the floor, and in addition, the charging machine, weighing about 50 tons complete, is given a traverse motion. The scoops are withdrawn by the motor used to insert them in the retort.

Each retort is charged with from 900 lb. to 950 lb. of coal every seven hours, and the time of charging and discharging an individual retort is very small. One of the charging machines is held as a reserve, and each has five induction motors ranging in size from 2 hp to 20 hp. The controllers are of the automatic type, on the charging machines. The work done by the motor-driven charging machine has enabled the company to handle its retorts with three men, an additional man being required to run the machine itself, whereas under the former conditions of hand charging 15 men were required to do the work. With the electric charging machine the retorts are filled in the minimum time and the spreading of the coal is done far more evenly than was possible by hand. It is unnecessary to make allowances in the retort for discrepancies in the level of the fuel bed, which with some plants reach a total of 2 in., even with belt-driven charging equipment. The yield of gas per pound of Westmoreland coal averages from 5.9 cu. ft. to 6 cu. ft. of 17-cp gas, compared with 4.95 cu. ft. of 14-cp gas in the old retort house of the Worcester Gas Light Company.

When the coke is pushed from the retort it is dropped upon an electrically driven conveyor and carried out of the house. The conveyor is simple in form and practically carries the coke instead of drawing or pushing it. After the coke is thoroughly drained and dried it is taken to a storage pile by an electric grab bucket, passing through a crusher equipment driven by a 10-hp motor. Telpher connections are also made with the boiler-room, water-gas house, and other parts of the plant.

There are two producers for each bench of retorts in the plant. The fuel is coke, and the producers are furnished with rocking grates kept in slow motion by an electric motor. The blower equipment is motor-driven, and constant speed has helped to make possible a uniform and constant amount of producer gas of a constant heating value. Two men during the day and two men at night not only take care of the rear end retort lids, but they attend to all the work on the producers of seven benches, so that each man takes care of 3½ fires.

With the electric telpher system installed at the plant there is no teaming or shoveling of coke around the works. Purifying material is handled by an electrically driven conveyor, and it has been determined that the coke conveyor on the discharge side of the retorts saves the labor of three men, only two being required at present. Mechanical difficulties and various friction losses in the plant are avoided by the use of electric motors. Mr. D. D. Barnum is superintendent of the plant. An ex-

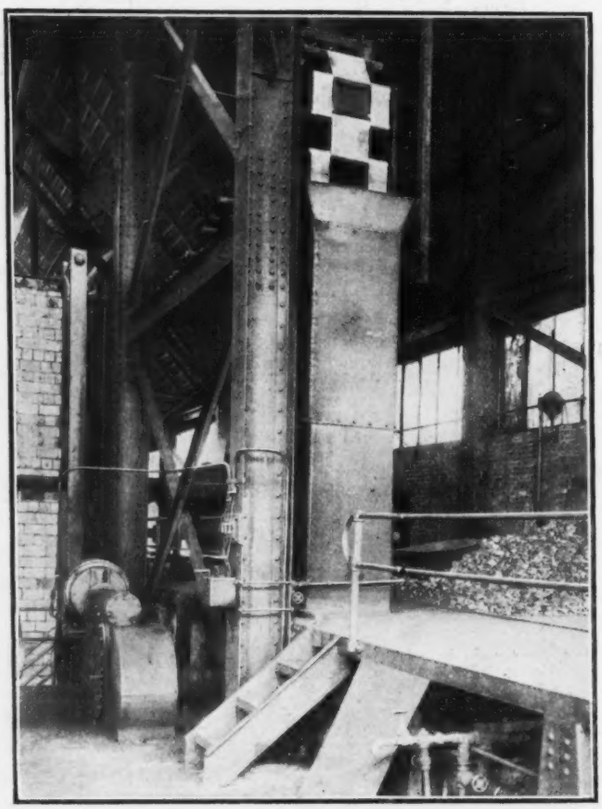


Fig. 4—Electrically-Driven Coke Conveyor.

haustive discussion of the chemical results of the plant's first 11 months' service was given by President Charles D. Lamson, of the Worcester Gas Light Company, before the October, 1909, meeting of the American Gas Institute. President Lamson referred several times in his paper to the successful applications of the electric drive in the charging and conveying equipment, and from the interest which has been aroused in gas circles in the performance of the plant it is certain that many other in-

stallations of the electrically driven type will follow the work being done at Worcester. The savings in labor are conspicuous even upon a short visit to the establishment.

MECHANICAL TESTS OF INSULATOR PORCELAIN AND GLASS.

By Ralph P. Clarkson.

RECENTLY it was found desirable to investigate high-voltage insulators for lines carrying upward of 125,000 volts and it was necessary to know something of the mechanical strength of those materials most commonly used for insulating purposes. Recent engineering literature and such reference books as could be obtained were searched for information as to mechanical tests of porcelain and glass, and for the methods of making such tests; but no illustrated article was found, and only the very slightest information that such tests were ever published. The writer, therefore, conducted the following experimental tests in the well-equipped laboratory of the Worcester Polytechnic Institute and offers them, not as exhaustive, but simply to show in general what users of insulators may expect.

The requirements of a good insulator are many, but the chief one is that it must be of low price. This limits the material of which the insulator may be made, and glass and porcelain seem to be the best because of their mechanical as well as dielectric strength. Of these two substances, glass is the better in a great many ways, but it has not been made into as good an insulator as the porcelain except at a much greater expense. Glass appears to be more homogeneous and flaws are easily detected by the eye. There are no dark corners where insects can build their nests. It is also less hygroscopic than porcelain, but does not possess the mechanical strength. The subject of making an electrically and mechanically strong glass has not received the attention it deserves from a chemical standpoint. It is known that glass made for other purposes by the famous Jena glass works has been found to possess electrical properties superior to any usually found and that that glass is very free from any tendency toward surface disintegration.

Because of the above facts, which were known to the writer, and because of the difficulty in obtaining fair glass cubes, only tension tests of glass were made. The glass used was obtained from a prominent manufacturer and the samples were taken from a batch of ordinary insulator glass, having been made about three years before the tests on them were conducted.

Both glazed and unglazed porcelain samples were tested in tension and compression, and the results investigated. All the porcelain was made from a standard formula and was identical with that from which a high-class line of high-voltage insulators are made and the glaze was the standard glaze used on that line of insulators.

It was desired that the tests should be made on standard shapes of materials in order that the results should be easily understood and comparable with other experiments. The shape of the samples of porcelain tested in tension was the standard briquette recommended by the American Society of Civil Engineers for tension tests of cement. It was impossible to get the glass in exactly that shape, but Fig. 1 shows the form used, this differing in no essential point from the shape recommended. The porcelain was, however, obtained very near the standard form, shrinkage causing some variation from the dimensions. The samples of glazed and unglazed porcelain were in the shape of a cube for the compression tests. Their size varied, but a large number of 1 in. on an edge were tested. The porcelain used was not in any sense special, and the flaws found in all insulators were found in these samples. Fig. 2 gives an idea of what those flaws were—a large, round, very hard piece of porcelain imbedded or an open crack where the clay did not stick together.

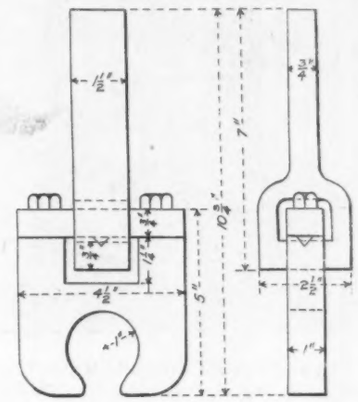


Fig. 4—Design for Cast-Iron Holding Clip.

The testing machines used were standard instruments. For tension tests of glass the Fairbanks briquette testing machine was used, but this has a capacity of only 1000 lb. so that a Wicksteed 20,000-lb. testing machine was used for the porcelain tests, both in compression and tension, except in a very few cases, which were not recorded, when an Emory hydraulic testing machine having a capacity of 100,000 lb. was used, simply to investigate the peculiar fracture and to see if it was due to the method of applying the load.

The Fairbanks machine is shown in Fig. 3. The briquette is held in brass clips at *A* and the weight applied uniformly by a stream of shot which runs from a reservoir through the tube *B* into the pail *C* suspended at the end of the steel yardarm upon which the weight *D* slides. When the briquette breaks, the arm falls, automatically cutting off the flow of shot. The shot is then weighed by means of the balance at *E*. The rate of applying the weight or load was about 475 lb. per minute.

The Wicksteed machine is merely a system of levers by means of which the load is applied by hand, or otherwise, and then balanced by the sliding weight so that readings may be taken directly.

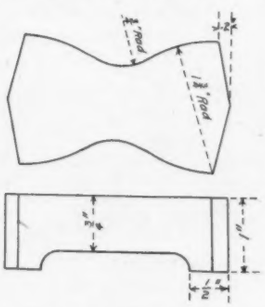


Fig. 1—Shape of Glass Briquettes.

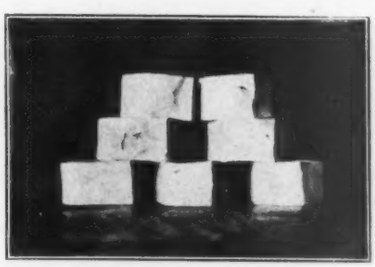


Fig. 2—Flaws in Porcelain.

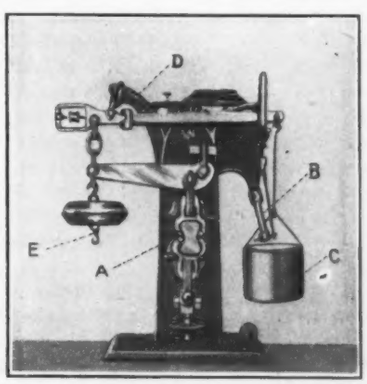


Fig. 3—Fairbanks Concrete Testing Machine.

The clips by means of which the briquette is held and the stress applied are the most important part of a testing machine. Brass clips were used for the glass samples, and were satisfactory, but in order to test the porcelain it was necessary to make very heavy clips so that they would not spread when the load

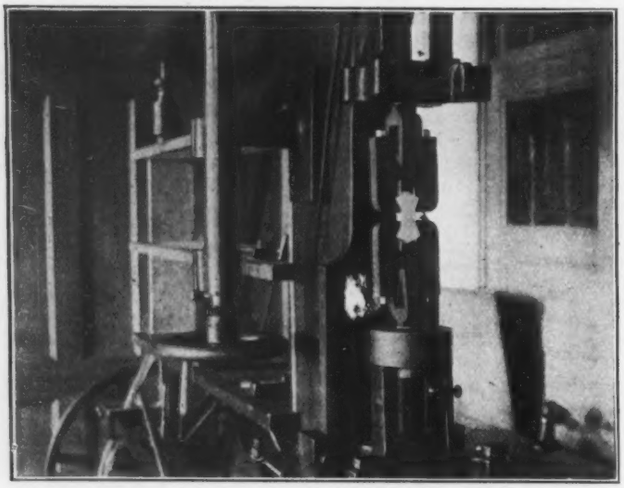


Fig. 5—Porcelain Briquette Under Test.

was applied to the briquettes. Cast-iron clips were obtained in accordance with the design shown in Fig. 4 and were found to work very satisfactorily. Fig. 5 shows the clips in use on the Wicksteed machine, an unglazed porcelain briquette being in place.

To a great extent the methods used in testing cement were followed. Care was taken to center the briquettes carefully in the clips and then a slight initial load was applied and the zero reading taken. For the tension tests of the porcelain the load was applied by steps of 100 lb. up to 1000 lb. and then in steps of 50 lb. until the sample broke. Each load was carefully balanced by means of the sliding weight so that the results are very accurate.

Considerable difficulty was encountered in getting the porcelain to break at the smallest cross-section, but finally by using pillows of cardboard between the clips and the briquettes the break occurred, in most cases, very near to the smallest section. It is not to be expected, however, that the smallest section is necessarily always the weakest when porcelain is used. This is due to two causes, and these are the factors which make porcelain so uncertain in its action. First, the smallest section is, of course, more thoroughly baked than a large section of the same piece. Secondly, the flaws shown in Fig. 2 are very frequently found in all large pieces of porcelain and, many times, they are the determining factor in finding the strength. The lack of homogeneity in porcelain is a serious drawback.

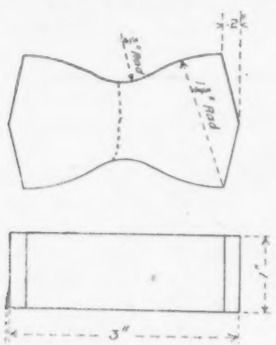


Fig. 6—Standard Form of Briquette.

Fig 6 shows the shape of briquette recommended by the American Society of Civil Engineers, and the dotted line shows how the majority of fractures ran. The breaks were all clean and even, and the samples showed no signs of being crushed at the sides or of splintering.

It may be of interest to note the method of computing the section where the break occurred. It seemed very much of a problem to do this accurately, but the plan finally adopted seemed to give as close results as any. The specimen was placed upon sensitized paper, such as will be turned black by contact with brass (ordinary steam-engine indicator cards were used), and a sharp brass needle point was used to mark around the section. Both halves of the sample were used in each case, and each was traced around a number of times. The area thus obtained was integrated with a planimeter.

Fig. 7 gives a curve sheet showing the results of the tension

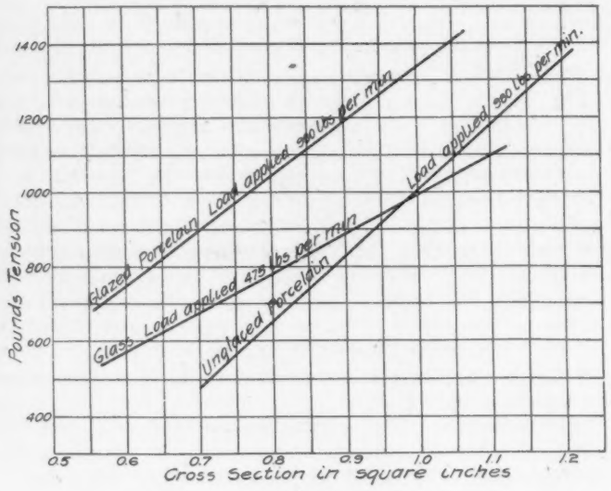


Fig. 7—Tests of Tensile Strength.

tests using glass, glazed porcelain and unglazed porcelain. The cubes used for the compression tests did not have perfectly flat faces and so it was necessary to provide even bearing surfaces for them that the breaks might be in compression and not in tension or shear. It was found that it is possible to grind the unglazed porcelain with a coarse emery or corundum wheel, but the grinding must be done very slowly and carefully or the surface becomes all glazed over. The plan decided upon in this case was to bed the cubes on lead sheets about 1/16 in. thick. When the load was applied the lead flowed slightly and

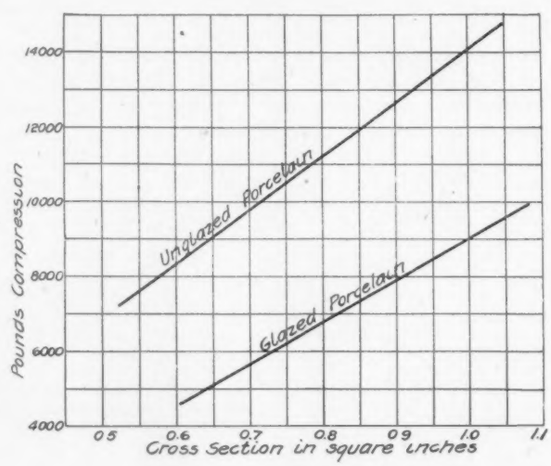


Fig. 8—Tests of Compressive Strength.

very thinly around the edges and curled up, thus possibly giving some very slight additional strength to the cubes.

The porcelain fiber showed up better in these tests than in any other tests of the substance. The fracture took place in lines at right angles to the face of the jaws so that the specimens, instead of crushing as many substances do, splintered into a number of pieces. Different beddings, different rates of applying the load and different methods of applying the load were all tried, but the fracture was always the same. The curve sheet, Fig. 8, shows the results of the compression tests on both the glazed and unglazed samples.

The conclusions which might be drawn from these tests are

very many. In tension glass and unglazed porcelain have about the same strength. Glazed porcelain is about 25 per cent stronger than either. This is to be expected as glaze would probably have the same effect as the scale does on cast iron. In compression unglazed porcelain seems to be stronger than glazed, but the strength of porcelain in compression is from 10 to 12 times its strength in tension. It is rare that such a proportion is found with the more common substances used in construction, cast iron being a fair sample of the proportion usually found, five to one.

The writer believes that tests of porcelain beams would be of great value in the study of that substance, especially cantilever beams, as that is usually the way that insulators are strained. Such tests would assist materially in the study of the work outlined above.

THE TUNGSTEN LAMP SITUATION IN FRANCE.

Rapid Introduction of Tungsten Lamps in Paris.

BY WARREN H. MILLER.

IT may seem incredible, but there are practically only two kinds of store lamps in Paris to-day, namely, the gas mantle and the tungsten lamp. To these may be added the arc lamp which is used in large establishments, but the average store is almost invariably lighted either by gas mantles or by tungsten lamps. It seems curious that one must actually hunt in order to find an installation of carbon lamps; the writer traversed the whole circle of the Grand Boulevards, from the Madeleine to the Chatelet, and noted only one carbon-lamp outfit, and that was in the artificial flower decoration of a theater front, where the steel network of leaves and flower lamps was much shaken by the wind.

One passes store after store, mile after mile of boulevards, and never sees a carbon lamp. All of the stores are brilliantly lit with from 25 to 50 lamps, the 25-cp and 50-cp sizes predominating. The brittleness of the filament, which is a great stumbling block in America, has been entirely overcome in European lamps. A sure indication of brittle lamps is the discovery here and there of dead lamps in clusters and the like, for such lamps are not quickly replaced unless used in some important store window, but the writer was not able to find any such, except in rare cases. In a large concert hall, with grand organ making considerable vibration, out of 75 50-cp tungsten lamps only two were dead. Pursuing the investigation further, the year's average of breakages for last year was returned as 2.7 per cent, for large companies such as the French Westinghouse, the lamps of which are made in its own Austrian and Swiss factories. Of those failing, 1.5 per cent was debited to shipment, 0.4 per cent to defective sockets, and the rest to broken filaments, most of which parted at the weld with the metal spider, where the joint is stiff and inflexible.

Aside from the use of improved methods of obtaining the oxide as rich as possible, the freedom from breakage is mostly ascribed by foreign manufacturers to the use of a fine, springy filament, which is drawn down to 0.027 mm in diameter through diamond dies. They consider the 16-cp size on 135 volts as the best of the lot, but the people prefer the 25-cp lamp because of its better light. The principal operating difficulty at the factories at present seems to be to make the diamond dies last longer, as they soon draw large. Another cause of freedom from breakage is the use of a platinum spider to hold the loops of filament at the lower end. This spider is bent back in tension like a bow, so as always to follow the expansions and contractions of the loop and always keep it taut, and yet never be bound by anything stiff and unyielding, such as a stiff spider at both ends. The latter design is often found in American lamps, the filament being permitted to sag on heating and thus be particularly subject to rupture; it also introduces flexure while hot, which probably distorts the fiber of the metal. However this may be, the writer's experience with over 5000 American tungsten lamps showed that while they withstood shipment and placing in sockets very well, after they had been in service for several nights they became very brittle indeed, so that one could not shift the lamps from one department to another, in case of lamp famines, without losing more than half of the lamps transferred.

It might be mentioned here that a state of famine in lamps was chronic, so long as tungstens were used, because they broke much faster than they could be ordered and shipped. The French experience has been exactly the opposite of this as regards the lamps becoming brittle when in service. Their lamps become harder and tougher, and it is standard practice at the factories to heat each lamp for four hours before shipping in order "to toughen the filament."

There are more than 500,000 tungsten lamps in use in the Paris stores, public buildings and private houses at present, something like 200,000 being supplied by the "Osram" Company, 150,000 by the French Westinghouse, and 150,000 by the "Z" Company, and others. This means that the householders and shopkeepers of Paris are saving about $8,000 a night by the use of tungsten instead of carbon lamps. They are operated in all sorts of positions, vertical, horizontal, at all angles, and upside down. No attempt of any sort has been made to introduce spring sockets and fixtures, such as are extensively advertised in America. The Frenchman is nothing if not logical, and he instinctively realizes that if the tungsten lamp is worthless because of brittle filaments, it is better to toughen the filament or else to have no tungsten lamp at all. The idea of treating the lamp as a delicate and evanescent soap-bubble, and hanging it with extreme care in canary-bird spring cradles, appears to him highly illogical. He believes that if the lamp filament is brittle, the lamp is not yet ready for the market, and it is a crime to sell it. Logical thought further drives him to invest considerable of his meager capital in expensive arc lamps, 25-cp tungsten lamps at 60 cents each, and gas mantles at 20 cents each. He realizes that these things pay more in economy of light bills than the same money would return from the best kind of securities, and, therefore, he invests. He also realizes the value of light in attracting customers, and is not sparing with either tungsten lamps or gas mantles inside, or with flaming arcs on the street outside. American store managers, on the other hand, waste their gross profits in light bills for carbon lamps and plain gas burners, and get depressingly lighted floors in order to save a little capital, which lies moldering in the bank at 3 per cent, or is tied up in goods that no one can see to buy.

The tungsten invasion began with the private houses, where there is no such business-killing scheme as a "minimum rate" to make any saving by the use of tungsten lamps impossible. In France the companies are glad to make every dollar they can, and they install meters even if the customer uses far below any arbitrary minimum.

Having proved to the people in their own homes that the tungsten did save much in electric light bills, it was quickly extended to the stores. During the last year the companies tried to introduce the 16-cp, 135-volt lamps, and the people took gladly to them at first, because of the lower first cost of the lamp, but they soon returned to the 25-cp size to obtain more light.

The tungsten lamps are sold in France on a 1000-hour guarantee. Two years ago the companies stood ready to make good 5 per cent in returned and broken lamps, because the storekeepers never miss an opportunity to return any and all broken lamps to the meter-man. However, the breakage did not reach that total, and last year it was only 2.7 per cent, so that 3 per cent is now figured in in gross selling price to take care of broken and returned lamps.

The next places to introduce tungsten lamps were the large central stations. Later the municipalities adopted them, not only for public buildings, but for street lighting. In Bordeaux and Lucerne use is made of street clusters of three and four lamps in multiple, while in Zürich the scheme of using flaming arcs with an auxiliary 50-cp tungsten below it on the same pole is employed. After midnight the arc lamps are extinguished and the tungsten lamps lighted.

Meanwhile the short-filament, 25-volt, series tungsten lamp was coming into its own in the field of railway car lighting, where use is made of a storage battery feeding energy for lighting the entire train. Over 40,000 23-volt tungsten lamps, in 5-cp, 10-cp and 20-cp sizes, were sold to the Italian State Railways, 5000 to the Belgian State Railways, and 10,000 to the Orleans-Paris Railway by one lamp company alone.

At present the field of industrial establishments is being gone into extensively. The big gun works at Creusot are equipped with 3000 tungsten lamps furnished by two separate companies, while there are thousands already installed in the big cotton and silk mills in the south of France. In Paris, the Metropolitan (the subway of the city) has ordered a trial lot of 1000 lamps from several companies, after a test of 50, along the line of track where the vibration is heaviest. These were run in series

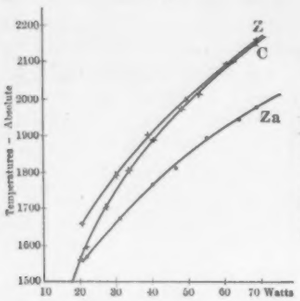


Fig. 1—Luminous Intensity Curves for Carbon Lamps.

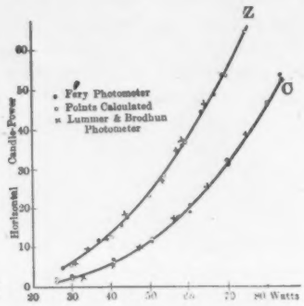


Fig. 2—Luminous Intensity Curves for Tungsten Lamps.

on 600 volts, five in a group—a pretty severe condition. The test of the 50 lamps was stopped at 1200 hours with only one broken.

It may be that the failure of certain American lamps was not due to the filament itself, but to the trivial cause of lack of proper support for the filament. In foreign lamps a small springy spider holds the ends of the loops in tension, in one form or another. There is also some attempt to hold the filament loosely in the middle, but the general tendency in 25-cp lamps is toward the use of short and many loops.

LAWS OF LUMINOUS RADIATION.

Some attempt to formulate the relations between the power consumed in metallic-filament lamps and the voltage, and between the temperature of the filament and the watts dissipated and between the luminous intensity and the specific consumption of the lamps has been published in *La Revue Electrique* for Jan. 15, by Messrs. Cheneveaux and Féry, as was noted in the Digest of the *Electrical World* on Feb. 10. The researches are divided into two groups: First, those aiming to find the relation between either the power consumed or luminous intensity and the voltage; and second, those endeavoring to find a law for calculating the luminous intensity, given the absolute temperature of the filament, or the wattage. The authors first review the various empirical formulas for the curve of luminous intensity in terms of the voltage. Expressed in simple form they are:

Laporte: Intensity $= KE^n$, where $n = 5.8$ for carbon and $n = 3.6$ for tungsten.

Steinmetz: Intensity $= KW^x$, where $K = I \times 5.10^{-3}$ and $x = 3$ for carbon and $K = I \times 1.10^{-3}$ with $x = 2.58$ for tungsten.

Jolley:

Intensity $= 3{,}20.10^{-10}\ E^{5.4}$ for carbon.

Intensity $= 4{,}79.10^{-7}\ E^{3.92}$ for tungsten.

Woodhull:

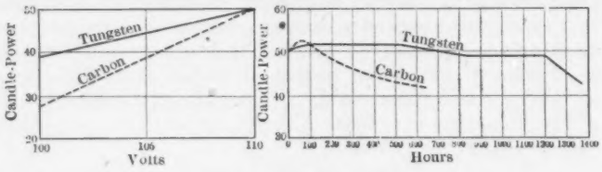
Intensity $= E^{5.6}$ for carbon.

Intensity $= E^{3.9}$ for tungsten.

The authors do not consider any of the above values sufficiently precise for a theoretical basis and evolve the general formula:

$$\text{Intensity} = AE^{x\sqrt{W}}$$

giving the law of the luminous intensity as a function of the watts dissipated, no matter what the character of the filament. A and B are constants characteristic of the particular lamp and x has the value of 4 for carbon and 4.6 for tungsten. This



Figs. 3 and 4—Candlepower Curves.

formula is based on a simple expression of the law of Stefan, which, reduced to watts in terms of the absolute temperature, would be $W = aT^4$ for carbon lamps with black filament, and results calculated from it are given in Table I. To get the formula in practical shape for tungsten filaments Messrs. Cheneveaux and Féry point out that it would introduce an error to

TABLE I.—CARBON LAMPS.

Volts	Amperes	Watts (W)	Temperature Absolute (T)	$a = \left(\frac{W}{T^4}\right) \times 10^{12}$
			°C.	
14.2	1.18	16.8	1543	3.06
16.0	1.34	21.4	1638	2.97
18.0	1.51	27.0	1753	2.84
20.0	1.685	33.7	1848	2.87
22.0	1.86	40.8	1933	2.92
24.0	2.04	48.9	2013	2.97
25.0	2.12	53.0	2053	2.98
27.0	2.29	61.8	2133	3.00
29.0	2.46	71.4	2203	3.01

W (watts)	$\sqrt[4]{W}$	Candle-power		Difference in Per Cent
		Calculated	Observed	
26	2.25	1.4	1.4	0.0
30	2.34	2.3	2.3	0.0
40	2.51	5.97	6.0	0.5
50	2.66	12.3	11.9	3.1
60	2.78	20.7	20.3	2.0
70	2.89	32.2	31.8	1.2
80	2.99	46.3	46.0	0.7
84	3.02	52.4	52.4	0.0

consider the radiation from a highly polished filament equal to that of plain black carbon. They, therefore, conducted experi-

TABLE II.—TUNGSTEN LAMPS.

W	T	$a = \left(\frac{W}{T^{4.6}}\right) \times 10^{14}$
20	1699	2.77
30	1831	2.94
40	1943	3.00
50	2041	2.98
60	2125	2.96
70	2201	2.95

W	$\sqrt[4.6]{W}$	Candle-power		Difference in Per Cent
		Observed	Calculated	
28	2.063	4.8	4.8	0.0
30	2.094	6.0	5.85	+2.5
40	2.229	13.2	13.0	+1.5
50	2.340	23.6	23.3	+1.3
60	2.435	37.4	37.1	+0.8
70	2.518	54.0	53.7	+0.6
76	2.563	65.2	65.2	0.0

ments with polished platinum, whose temperature was measured with an accurate optical pyrometer, and the total radiation was taken at the same time with a Féry pyrometric telescope. The law was thus found to be $W = aT^{4.6}$ for highly polished surfaces under extreme heat; Table II shows the results obtained with tungsten lamps.

To ascertain the luminous intensity for carbon and tungsten

in terms of the watts, the authors first sum up the empirical formulas and results obtained to date by various experimenters. Tables III and IV give observations on record and the calculated temperatures derived from the formulas of Stefan, Rasch, Petavel and Nernst.

TABLE III.—TEMPERATURES.

	Watts per Candle	Temperature in Degrees Centigrade			
		Stefan	Petavel	Rasch	Nernst
Carbon	3.50	1557	1607	1647	1657
Graphitized carbon	3.13	1632	1667	1687	1717
Tantalum	1.645	1427	1707	1717	1737
Tungsten	1.25	1517	1827	1777	1807

Combining the law of Wein: $P = C\lambda^{-5} e^{-\frac{c}{\lambda T}}$, where P is the power radiated at wave-length λ, with the law of displacement of Wein; $\lambda_m T =$ constant, and substituting the values of T^4 in terms of W, the authors get:

TABLE IV.—TEMPERATURES.

Authors	Year	Type of Filament	Temperature Absolute
H.-F. Weber	1892	Carbon	1838°–1853°
P. Janet	1898	"	1883°–1993°
Lummer and Pringsheim	1899	"	1875°–2100°
Le Chatelier and Boudouard	1900	"	2073°
Waidner and Burgess	1906	"	1950°
" " "	1906	Tantalum	2000°
" " "	1906	Tungsten	2300°
Clerici	1907	Carbon	1950°
"	1907	Tantalum	2000°
"	1907	Tungsten	2300°
Grau	1907	Carbon	1933°
"	1907	Tungsten	2123°
Morris, Stroud and Ellis	1907	Tantalum	1850°
" " "	1907	Tungsten	2000°
W.-W. Coblentz	1909	Graphitized carbon	1843°
" "	1909	Tantalum	1943°
" "	1909	Tungsten	2083°

$$\text{Intensity} = 2{,}08.10^6 E^{\frac{-32.05}{\sqrt[4]{W}}} \text{ for carbon, as shown in Table I.}$$

$$\text{Intensity} = 3{,}08.10^6 E^{\frac{-27.63}{\sqrt[4]{W}}} \text{ for tungsten, as in Table II.}$$

In Figs 1, 2, 3 and 4 are shown all of the results of these investigations, both calculated and observed.

THE DESIGN OF A QUICK-ACTING WHEATSTONE BRIDGE.

BY CHARLES R. UNDERHILL.

IN the electrical departments of factories where thousands of coils must be tested daily it is imperative that the testing operation be performed with exactitude and dispatch. Where the ordinary Wheatstone bridge is used much time is lost in adjusting plugs or switch levers or closely observing the deflection of the galvanometer needle, in order that the resistance shall be within the prescribed limits.

While the maximum and minimum resistances may be easily calculated from the permissible variation in resistance, and the galvanometer deflection noted, changes due to temperature variation complicate the problem for ordinary shop testing and very often lead to error in the hands of semi-experienced testers. Again, when the resistance is outside of the prescribed limits, "guessing" adjustments and more calculating are necessary in order to determine the actual percentages of error.

Slide-wire bridges, designed to read directly in per cent, have proved to be even slower to operate than a good Wheatstone bridge equipped with a D'Arsonval galvanometer.

The writer has made numerous devices of this class, but the instrument illustrated in Fig. 1 and described below has given the greatest satisfaction of all, and possesses the decided advantage of being "foolproof" and, therefore, suitable for accurate use in the hands of an otherwise, inexperienced tester.

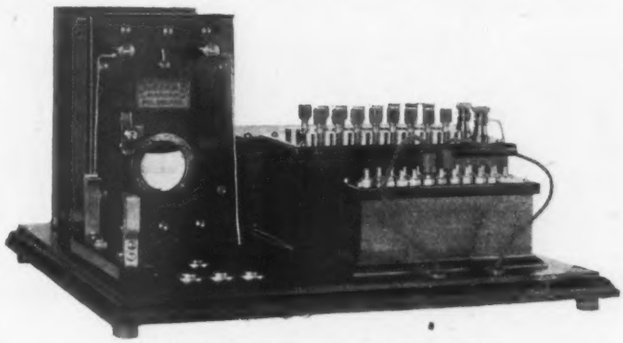


Fig. 1—Quick-Acting Wheatstone Bridge.

In this apparatus, as in the usual form of slide-wire percentage bridge, the battery and galvanometer circuits are transposed in respect to the familiar schematic diagram of the Wheatstone bridge.

In percentage bridges, the galvanometer circuit connection at a, Fig. 2, is adjustable for making A greater or less than B, the scale in the case of the slide-wire percentage bridge or the contacts in the present instrument indicating percentages of variation between R and X. Hence, if r represent the resistance taken from B and added to A to make $A > B$, the familiar equation

$$\frac{A}{B} = \frac{R}{X} \qquad (1)$$

will become

$$\frac{A+r}{B-r} = \frac{R}{X} \qquad (2)$$

or, when $A < B$,

$$\frac{A-r}{B+r} = \frac{R}{X} \qquad (3)$$

When $A = B$, $r = 0$, and

$$\frac{A}{B} = \frac{R}{X}$$

Therefore, equation (2) represents the adjustment necessary to obtain a balance when $R > X$, while (3) is for the condition $R < X$, and when $r = 0$, $R = X$.

On this basis, the instrument shown in Fig. 1 was designed. It consists of a rheostat, adjustable from 1 to 11,110 ohms, a D'Arsonval galvanometer, a single cell of dry battery (enclosed in the box back of the rheostat), and the adjustable "A" and "B" coils, shown in front of the rheostat. These latter coils are wound on a grooved wooden spool contained within the box, and are 22 in number, thus providing for adjustment of from 1 to 10 per cent, high or low, and one adjustment for $A = B$. Fig. 3 shows the connections of this detail with the value of

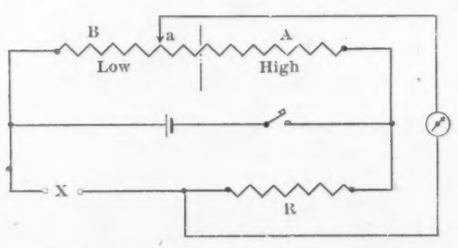


Fig. 2—Connections of Percentage Bridge.

the resistance of each coil. As an aid in calibrating these coils, the following is given: Starting from the center, or 0, the

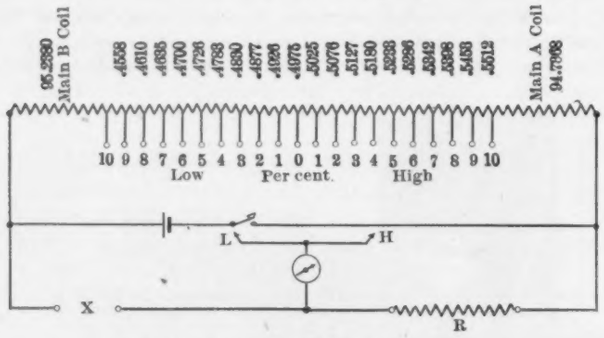


Fig. 3—Resistance Details of Resistors.

sums of the resistances, or the resistance as measured from 0 to the contacts, will be

Low	High	Low	High
1. 0.4975	1. 0.5025	6. 2.9117	6. 3.0927
2. 0.9901	2. 1.0101	7. 3.3817	7. 3.6269
3. 1.4778	3. 1.5228	8. 3.8452	8. 4.1667
4. 1.9608	4. 2.0408	9. 4.3062	9. 4.7120
5. 2.4391	5. 2.5641	10. 4.7620	10. 5.2632

The resistance of the main A coil is 94.7368 ohms, and $94.7368 + 5.2632 = 100$ ohms. Likewise, $95.2380 + 4.7620 = 100$ ohms for the B side.

The equations for calculating the values of the resistances for any values of A and B are

$$r = \frac{(1 + 0.01\,n)\,B - A}{2 + 0.01\,n} \qquad (4)$$

for the "low"side, and

$$r = \frac{A - (1 - 0.01\,n)\,B}{2 - 0.01\,n} \qquad (5)$$

for the "high" side, wherein n is the percentage (1, 2, 3, etc.), r is the resistance between 1, 2, 3, etc., and A and B are equal and represent the total resistance as measured from 0 in either direction (100 ohms in the present case).

Two contacts engage the pegs on the A-and-B box, one marked H being connected to the proper "high" peg, and the other, marked L, to the proper "low" peg. The complete connections are as in Fig. 4.

The operation of this bridge is exceedingly simple. The rheostat is first set for the actual specified resistance of the coil to be tested. The permissible variations in resistance (high

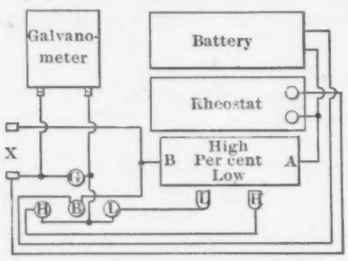


Fig. 4—Assembly of Apparatus.

or low) are then "plugged in" on the A-and-B box, temperature corrections being made from a scale of per cent of resistance due to temperature variation pasted on a thermometer, which is, therefore, direct reading.

The center, or battery, key is first depressed, as usual, and then the galvanometer is connected on the "high" and "low" sides of the A-and-B box by pressing first one and then the other of the keys H and L.

If the needle swings toward "low" when the "high" key is pressed it shows that X is lower than n per cent high. Likewise, if the needle swings toward "high" when the "low" key is pressed it shows that X is higher than n per cent low. Consequently, if the needle swings first one way and then the other it shows that the resistance of the coil to be tested, or X, is higher than the low limit and lower than the high limit.

On the other hand, if the needle swings, both times, toward, say, "high," it indicates that X is higher than the high limits, and is, therefore, too high. The same holds when X is too low, the needle swinging toward "low" when either the H or L key is pressed.

The actual percentage variation may be found by adjustment of either of the contacts on the A-and-B box, or one of these contacts may be placed on the 0 peg and the rheostat adjusted until a balance is obtained in the usual manner. The key marked G is used to short-circuit the galvanometer in order to bring the needle to rest after a violent swing.

The rheostat and galvanometer may be purchased at reasonable prices, and the remainder of the apparatus is not difficult to make. Those in operation have given genuine satisfaction.

ELECTRIC LIFTING MAGNETS IN THE STEEL PLANT.

Around steel plants, for handling the loose scrap and iron used for charging open-hearth furnaces, for breaking up pig iron, skulls, spilled metal, and slag, and for loading rails, plates and other finished products of the rolls, the electric lifting

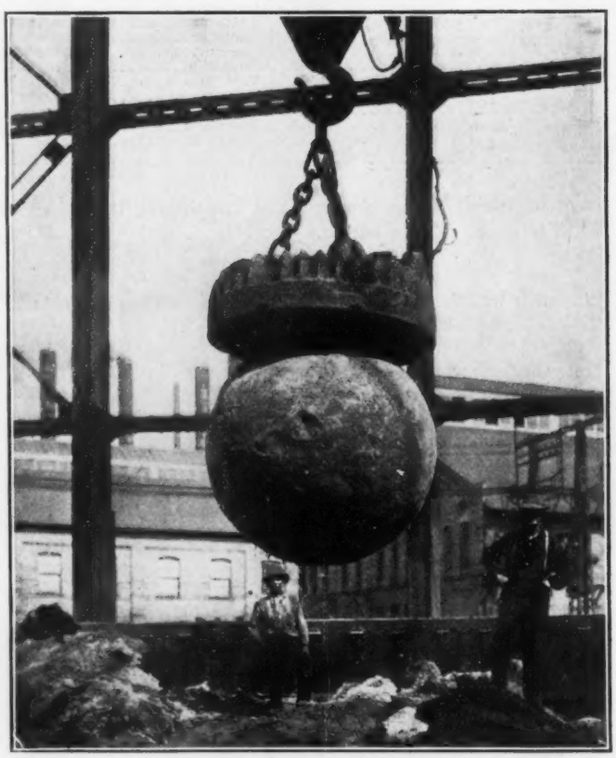


Fig. 1—Scrap-Handling Electromagnet Lifting 12,000-lb. Skull-cracker Ball.

magnet is a relative innovation in conveyance methods that has come to stay.

Continued advances have been made in the design and construction of these magnets, enabling them to lift increasingly greater loads and adapting them to withstand better the severe conditions of temperature change and moisture to which they are subject in service. Whereas the magnets of a few years ago were limited in carrying capacity, especially those used to

lift scrap and small, loose material, the best designs of to-day have no difficulty in "walking off" with 25 tons of slabs or billets, or a ton or more of pig or scrap. Confidently expecting the same progress in design and construction as in the past, we may look to see the future field of application of this interesting class of apparatus tremendously enlarged.

By the use of electric lifting magnets, the cost of handling many classes of magnetic material is cut in half or even a greater saving is accomplished. Many operations can be performed, too, which would be imposssible without the magnets. Finished material, pigs, billets, etc., can be piled to a height far above that reached before, effecting valuable saving in space. The magnet also renders comparatively easy the handling of the nondescript and inextricably tangled scrap, usually consisting of coils, springs, twisted wire, pipe and rods, machine-tool chips, casting parts, broken machinery, and ladle-spillings, which is added to the blast furnace charges. Hitherto, this

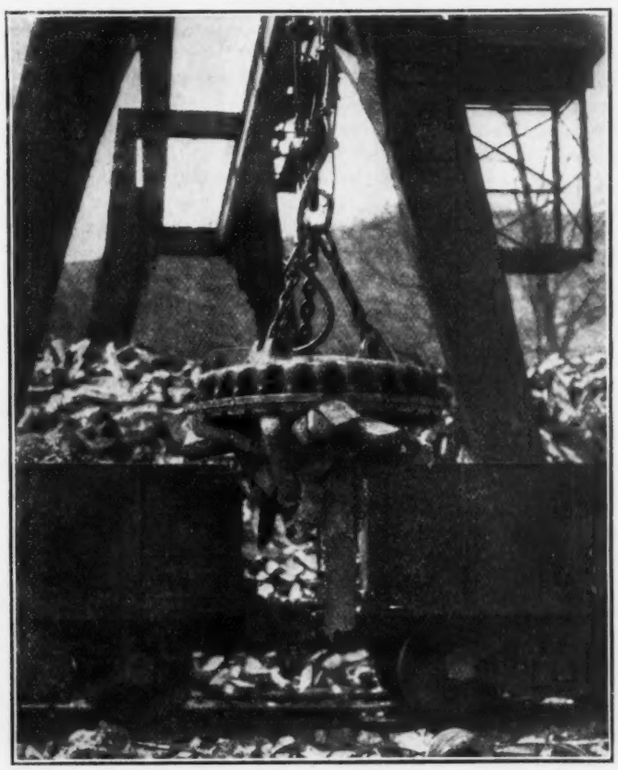


Fig. 2—Loading Pig Iron Into Cars by Electromagnet.

material could be moved only very slowly and at considerable expense by hand or by crane buckets.

The magnets by which plates and slabs are handled are usually lighter in construction and weight, and consume less energy than those required for picking up the small loose and rough material. Where the pieces lifted are relatively smooth and regular in shape, such as the commercial sizes of steel slabs and plates, a magnet of the rectangular form illustrated, with narrow pole-pieces widely separated, is used. This magnet requires about 12 amp at 220 volts, and will lift three or four plates at a time, aggregating four or five tons. It is controlled by a simple single-pole knife switch.

Considerable dexterity in handling difficult loads of plates and slabs is attained by the operators who manipulate the cranes and magnets. The plates coming from the live rolls are usually piled on an intermediate floor, from which they are picked up by the magnets for loading onto the cars. Some of the more skillful of the operators will raise two or three plates adhering together like the leaves of a book, and then, carrying magnet and all to the point where the bottom plate is to be dropped, are able, by snapping the magnet-switch momentarily open, to release the lowest plate and allow it to fall into position, before the contracting magnetic field has released the upper plates. In this way, three or four plates picked up in a pile by the magnet, can be dropped with accuracy one at a time in as many different positions.

Besides the crane operator, usually one or two ground men are required for loading duty, depending on the amount of

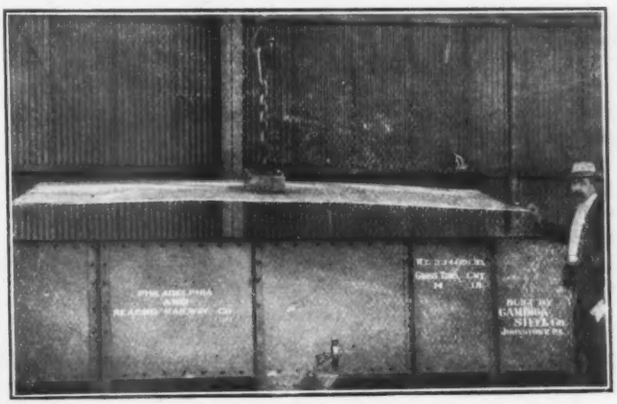


Fig. 3—Electric Lifting Magnet Loading Steel Plate Into Car.

work necessary in trimming the car after the material has been deposited by the magnet. This crew, however, replaces the former loading gang of eight men. Counting the maintenance of the magnet and crane as equaling something less than the wage of one man, the use of the magnet is seen to effect a labor saving of about one-half. Indeed, the statement is sometimes made that an electric lifting magnet will pay for itself within three months or less.

The electromagnets employed for handling scrap and pig iron, and for raising the skullcracker balls used to break up iron and slag masses, are a great deal heavier in both weight and structure than those for lifting plates. They differ in magnetic design, also, usually employing an outer annular pole-piece, concentric with the middle round pole-shoe, and

Fig. 4—Electromagnet Lifting 17 250-lb. Steel Billets.

being arranged with a comparatively short air gap, which renders the pole-to-pole flux more nearly independent of the magnetic conductivity and of the density of the loose material lifted. These magnets require currents of from 40 to 60 amp at 220 volts. They will handle several million pounds of pig

iron, scrap, or "noodles," as the punchings from the rivet shop are called, and are also able to lift easily a compact 10-ton load, such as a 2-ton ingot mold with its 8-ton ingot. By actual record in one steel plant where electromagnets have been in extensive use for the longest time of any in this country, one magnet handled 3500 tons of scrap in a week of seven working days of 24 hours each.

The control of the larger magnets is effected by mill-type contactors operated from a hand-lever. On account of the considerable inductive reaction when the 60-amp exciting current of one of the scrap magnets is broken, provision is made for automatically inserting a resistor in a discharge circuit to receive the inductive kick and so prevent a high potential on the windings. Another method for rapidly releasing the load by overcoming whatever residual magnetization remains after the exciting current has been shut off, provides for momentarily sending a reverse current through the magnet winding in series with a resistor so designed as to just neutralize the remaining field. Thus in dropping the load, the operator throws his controller over into a reverse position for an instant before bringing it back to the middle "off" position.

Another important use of the electromagnet is in raising and dropping skullcrackers—hugh iron balls, weighing from 6 to 10 tons—which are allowed to fall from a height of 50 to 70 ft. onto iron or slag masses that have to be broken up for better handling. Here the magnet takes the place of the former trip-latch and rope, by which the skullcracker was released by a groundman. This man had to look to his own protection against flying pieces, by getting behind a convenient runway column, and in this way the aim of the falling ball was often spoiled by the side-pull of the trip-rope. With the magnet controlled from the crane operator's station, much greater accuracy is attained in delivering the blow just where it is required. The magnet can also be used to put into position the iron to be broken, and afterward to collect the broken pieces.

A set of very large magnets of the horseshoe type, with flaring pole-pieces, designed to handle steel rails, was recently installed at Gary, Ind. These magnets, which have been frequently described of late, are capable of handling 20 60-ft. rails, aggregating a weight of over 30,000 lb.

The electromagnet used about the steel plant is a particularly sturdy and substantial piece of apparatus, but the service it undergoes in such a place is obviously of the hardest nature. The magnet is frequently dropped onto or allowed to crash against the solid skullcracker ball, an ingot mold, or a pile of plates and slabs waiting to be lifted. Unless its contact pole-pieces are made of the hardest material, they become worn off by attrition at a rapid rate. Manganese steel is used in some types of magnets for a sheathing between the poles, as this material is non-magnetic and one of the hardest steels known. Sometimes the magnet is called upon to lift hot metal—at a temperature just below dull red—and frequently it must work under a water spray used to cool the finished billets.

The most frequent source of trouble with magnets under these severe conditions is the grounding of the coils, due to deterioration of the insulation caused by the entrance of moisture. With the changes in temperature undergone by the magnet interior, when in use and when shut off, it is evident, despite the most careful measures to construct air-tight joints in the case, that the expansion and contraction of the internal interstitial air will cause a "breaking" action, which permits the entrance of moisture. This ultimately spoils the insulation, and a ground occurs between the coil and the case, putting the magnet on the hospital list for repairs.

The electrical superintendent of one large steel plant reports that repairs of this kind are required on his magnets on an average of about once a year. As is characteristic of steel-mill machinery, the electrical apparatus is worked continuously until it completely fails, when it is then laid aside for repairs. Important machinery, an accident to which might cause a critical interruption, is of course regularly inspected for the development of possible trouble, but such appliances as the cranes, magnets, etc., are usually worked without heed at top-rate production until failure occurs in some part. Then the whole is thoroughly overhauled, as it is found that this practice keeps the device out of use the shortest proportion of time.

The magnet coils are usually impregnated by a vacuum treatment by the manufacturer, but after the first rewinding and repairs in the mill shop, where only a filling compound is inserted, they, of course, lack the protection of the complete impregnation, and are more subject to the grounds above mentioned.

In the experience of the company above cited the upkeep of a crane and electromagnet equipment, including all repairs and renewals, should not exceed $500 per year.

THE UTILIZATION OF EXHAUST STEAM.

By Herman Niemetz.

The central station being concerned exclusively with the transformation and sale of energy has done much to develop economy of such transformations in order to obtain a maximum return from a given investment. One of the most serious losses has been the heat energy exhausted from the engine and absorbed by the condenser cooling water. This loss appears at sight to be unnecessary and many ingenious schemes have been devised to reduce it to a minimum.

The binary engine developed by Professor Josse, of the Berlin Royal Technical Institute, was a very successful attempt. This engine consisted of two units, one using steam and the other sulphur dioxide; the exhaust steam being utilized to vaporize the sulphur dioxide. The use of two working substances introduced complications which made this engine impracticable for central-station work, so that it has never come into more than very limited use.

A more practical expedient in reducing these losses is the exhaust-steam turbine operating at very high vacuum. This method is especially successful in large plants, or in low and medium pressure plants equipped with reciprocating engines operating at rather poor economy. The turbine is particularly well suited to the utilization of low-pressure steam because of the ease with which it can be made to take care of large volumes of vapor that could never be utilized in a cylinder with a reciprocating piston.

The steam turbine has introduced many new possibilities in the way of economy and there is reason to believe that many

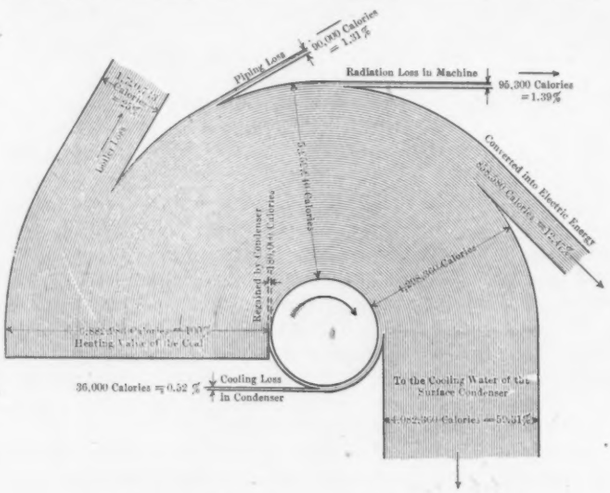


Fig. 1—Heat Balance, Condensing Unit.

more will be discovered as the art develops. The steam turbine does not introduce oil into the steam, therefore, the exhaust steam can be used to advantage in heating systems or discharged into the boiler feed. In addition to this advantage in heating

plants is the fact that steam of any desired pressure can be taken from the turbine by tapping into an intermediate stage, the turbine serving as a reducing valve. Two classes of turbine unit are adapted to use in connection with the generation of electric energy and the supply of steam to a heating system. One, the back-pressure turbine, and the other, the reducing turbine.

In order to make clear the advantages to be gained by these methods of operation, concrete examples will be chosen and the energy losses investigated with different methods of operation. Assume a high-pressure turbine unit having an output of 1000 kw with steam at 170 lb. per square inch and 572 deg. Fahr. (about 200 deg. superheat), and exhausting into a surface condenser at 28.5 in vacuum, cooling water at 60 deg. Fahr. The full-load steam consumption of this unit is taken as 15,850 lb. per hour.

The energy transformations from the coal to the exhaust are clearly shown in the diagram, Fig. 1, which represents the energy in pound-Fahrenheit heat units at different stages in the process. The power output of 1000 kw corresponds to 3,420,000 heat units per hour and the calorific value of the entering steam is 1323 heat units per pound, therefore the total hourly input to the turbine is $15,850 \times 1323 = 20,900,000$ heat units. The difference between the input and the electrical output is 17,480,000 heat units per hour and represents two groups of losses, namely: the machine losses and the exhaust losses. The machine losses include radiation, bearing friction, ventilation and electrical losses, and in this analysis this group of losses is assumed to be 379,000 heat units, while the remainder, 17,101,000 heat units per hour, is delivered to the exhaust. If the condensed steam is assumed to have a temperature of 86 deg. and that this temperature drops 9 deg., due to radiation, before the water reaches the boiler, then, radiation loss $= 15,850 \times 9 =$ 142,600 heat units; heat returned to boiler $= 15,850 \times 45 = 713,250$ heat units; total heat carried from condenser by steam $= 15,850 \times 54 = 855,850$ heat units. Therefore, the loss in the condensing water is $17,100,000 - 855,850 = 16,245,150$ heat units.

Next, working backward from the engine to the boiler, a loss of 7 lb. per square inch in pressure and 45 deg. in temperature is assumed. This corresponds to 22.5 heat units per pound of steam, or 363,400 heat units per hour. Summing the losses and assuming a boiler efficiency of 75 per cent the total calorific value of the fuel is found as below:

ITEM	Heat Units	Per Cent
Condensed steam pipe	142,600	0.52
Condenser cooling water	16,245,000	59.31
Electrical output	3,420,000	12.47
Machine loss	379,300	1.39
Steam pipe loss	363,400	1.31
Boiler loss	6,850,000	25.00
Total or fuel value	27,400,000	100.00

If the calorific value of the coal is taken at 12,600 heat units per pound, there will be required 2175 lb. of coal per hour to generate the 1000 kw.

If this 1000 kw were generated in a turbine unit carrying 28.5 lb. per square inch back pressure, the full-load steam consumption might have been 47 lb. per kw-hour, and the exhaust steam would have been available for heating purposes. Assuming a unit of this kind, the following heat balance is given:

ITEM	Heat Units	Per Cent
Cooling loss, condensed steam	856,000	1.10
Available for heating	52,644,000	67.62
Electrical output	3,420,000	4.38
Machine loss	400,000	0.53
Steam pipe loss	1,067,500	1.37
Boiler loss	19,462,500	25.00
Total or fuel value	77,850,000	100.00

Therefore, the amount of coal required per hour to produce 1000 kw and 52,644,000 heat units for heating is 6180 lb., assuming the thermal value of the coal to be the same as in the first example.

In order to compare this back-pressure turbine plant with a low-pressure heating plant it will be assumed that the 52,644,000 heat units are generated in low-pressure boilers and that the 1000 kw are produced by the high-pressure condensing turbo unit analyzed in the first case. The heat balance of the low-pressure heating plant, assuming condenser water to be at a temperature of 70 deg. and to lose 10 deg. on its return to the boiler, the following heat balance may be written:

ITEM	Heat Units	Per Cent
Cooling loss of condensed water	831,000	1.13
Available for heating (including pipe loss)	52,644,000	73.87
Boiler loss	17,825,000	25.00
Total or fuel value	71,300,000	100.00

The coal required by this heating plant is 5700 lb. per hour, which, added to that required by the condensing turbine as found above, makes a total of 7875 lb. per hour as compared to 6180 lb. used in the back-pressure plant. Therefore, the back-pressure plant shows a saving of 1685 lb. of coal per hour. Furthermore, the first cost and maintenance of the back-pressure plant is less than that of a plant having both high and low-pressure boilers.

Looking at it from another direction, the back-pressure plant required 6180 lb. of coal per hour, 5700 lb. can be considered as used to produce steam for heating, then 480 lb. is all that is required to produce 1000 kw-hours, or 0.48 lb. per kw-hour. This coal consumption, when taking the condensing unit at 15.85 lb. of steam and 2175 lb. of coal per hour as a basis, corresponds to a steam consumption of

$$15.85 \frac{480}{2175} = 3.5 \text{ lb. per kw-hour.}$$

The use of back-pressure turbines in connection with central-station heating plants is being tried out on a large scale by some

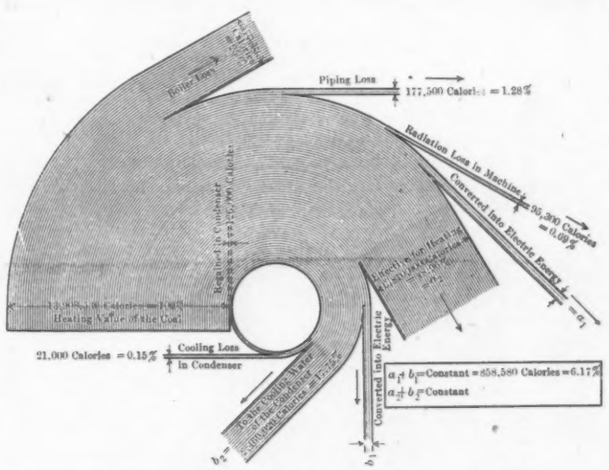


Fig. 2—Heat Balance, Pressure Reducing Unit.

central-station companies in the United States. Turbine stations are located at different points on the system and the exhausts connected directly to the steam-heating mains. One of the great advantages of this system is the low cost of the station equipment and the great saving in feeder copper.

The bleeding of condensing turbines at an intermediate stage offers greater flexibility of operation than the use of back-pressure turbines, although it involves a slightly greater first cost. The analysis of a concrete example along the lines employed above will bring out the various points involved.

Assume a 1000-kw condensing turbine arranged for bleeding, the steam required for heating amounting to 22,000 lb. per hour at a pressure of 28.5 lb. per square inch. Basing the calculations on the assumptions used in the previous examples the heat balance (Fig. 2), shown in the table following, is obtained.

The coal consumption, assuming the same heat value as before (12,600 heat units), is 4400 lb. per hour. With the high-pressure condensing turbine unit alone, the coal consumption was found to be 2175 lb. per hour. The previous calculation for low-pressure steam generation showed that it required 5700 lb. of coal to produce 47,000 lb. of steam; that is, 1 lb. of coal generated 8.25 lb. of steam at 28.5 lb. per square inch. Therefore, in this case, 22,000 lb. of steam would require 2670 lb. of coal if generated in low-pressure boilers, the total being 4845 as against 4400 with the turbine.

Item	Heat Units	Per Cent
Cooling loss, condensed steam	83,600	0.15
Condenser cooling water	9,887,300	17.75
Available for heating	27,110,000	48.96
Electrical output (total)	3,420,000	6.17
Machine loss	379,600	0.69
Steam pipe loss	707 000	1.28
Boiler loss	13,862,500	25.00
Total or fuel value	55,450,000	100.00

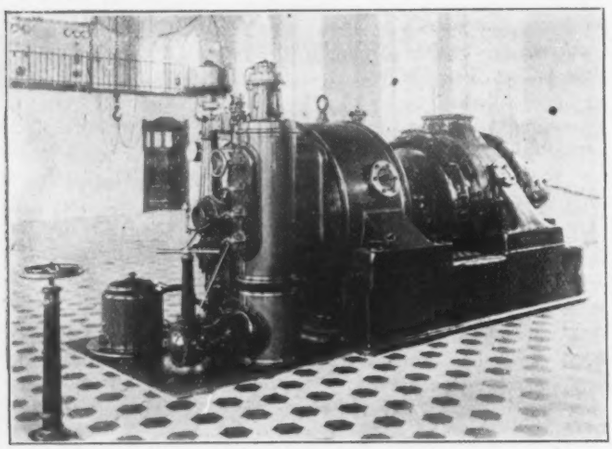


Fig. 3—Back-Pressure Turbine Unit.

The advantage of this method is the ability to always get full power at maximum turbine economy independent of the heating load. When using all the steam for heating the machine runs as a pure back-pressure unit with the low-pressure stage in a vacuum. Enough steam must be let through the low-pressure stage to keep the condenser in operative condition. On the other hand, if no steam is used for heating, then the unit runs as a straight condensing machine, and at maximum steam economy. At any intermediate load condition the heating steam will be supplied in the amount required and the power required above that developed in the high-pressure stage will be developed by steam taken through the low-pressure stage.

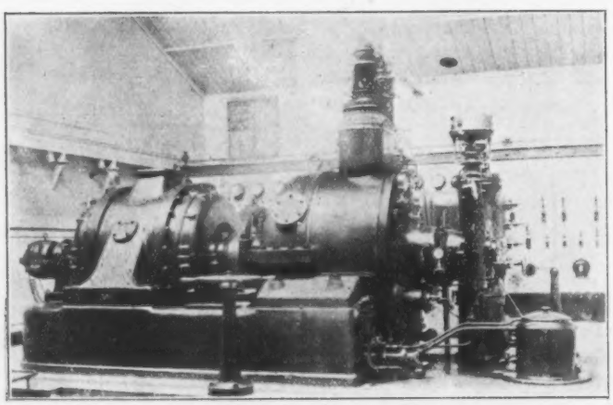


Fig. 4—Reducing Turbine Unit.

Figs. 3 and 4 show actual installations of the back-pressure and reducing turbine, respectively. These turbines are of the Allgemeine Elektricitäts Gesellschaft make, and are used in manufacturing plants where large quantities of steam are required for heating purposes. In this type of turbine the regulation is accomplished solely by automatic adjustment of the admission, independent of the amount of steam required for heating.

BOILER AND ENGINE ROOM PRACTICE OF THE BROOKLYN EDISON COMPANY.

In a portion of a paper on "Electric Power-Plant Operation" read at the convention of the Brooklyn Company Section of the National Electric Light Association at Manhattan Beach, N. Y., June 24, Mr. C. H. Courser gives some interesting facts on the boiler room practice in the Gold Street station of the Edison Electric Illuminating Company, of Brooklyn. In this station there are 14,600 boiler hp., made up of 650-hp and 750-hp Babcock & Wilcox units. The boilers are equipped with what are known as Webster furnaces, a kind of Dutch-oven arrangement for immediately igniting the fuel when it is thrown on the fire. Each boiler is fitted with superheater and shaking grates. The latter are divided into eight sections to enable the firemen to shake any portion of the fire requiring it, and also to enable fires to be carried at any desired thickness. The number of boilers in use varies with the load During the day each boiler supplies 1000 kw of turbo-generators and during maximum load each boiler is forced to feed 1500 kw of generating apparatus.

The boilers when not in use are banked. The fire is first cleaned, spread over the grate and then covered heavily with coal. The dampers are closed, cutting off all draught. During this process, the steam pressure in the boiler drops below the pressure in the mains. This causes the automatic stop valve on the top to close, the valve remaining closed while the boiler is banked. When the boiler is needed for service the dampers are opened and the fire shaken. When the steam pressure has been brought up to 1 lb. in excess of that of the mains, the automatic stop valve opens and the boiler is then in service.

After a boiler has been out for repairs or internal cleaning the process of starting is as follows: First, it is filled with water to the lower gage cock and the superheater flooded. The grates are then covered to a depth of 3 in. with bituminous coal and fire from another furnace is thrown in on top. This is carefully covered with a little bituminous coal and a small amount of draught put on. As the fire builds up and the water in the boiler begins to steam, the tube caps at both front and rear are examined for leaks; the joints around the stop valves, cross-over pipes and superheater connections are examined. If found tight, the fire is gradually increased until the boiler has about 40 lb. steam pressure. The flooding valve on the superheater is then closed and the water blown out. The drip on the boiler bend connecting the automatic stop valve with the header is opened, and then the gate valve on the header end of the bend This allows the steam pressure from the other boilers to come to the upper side of the automatic stop valve. The hand-operated stem on this valve is opened, and the steam pressure on the boiler carefully watched, until the pressure has become 1 lb. or 2 lb. more than the line pressure. At this point the stop valve will open and the boiler is then in service.

The water-tender is responsible for the condition of the fires, the height of the water in the boilers, and the steam pressure during his watch. He reports directly to the boiler-room engineer, who is responsible for the entire boiler house and all men connected with it during his eight hours on duty.

A daily logsheet is kept showing the hours steaming and the hours banked for each boiler, and when closed; also an hourly record of steam pressure, steam temperature and feed-water temperature. The feed water is supplied to the boilers by two four-stage centrifugal pumps, each driven by a 225-hp steam turbine.

The water of condensation from the condenser hot wells is pumped by 5-in. centrifugal pumps driven by 35-hp steam turbines, either into the heater or into the river. The water necessary to replace that lost by blowing-down boilers is taken from the city mains into the heater and controlled by a float valve. From here the water drops into the feed pumps, and is pumped through the feed mains under 225-lb. pressure to the boilers; each boiler being controlled individually by a feed valve operated by the water-tender.

The Gold Street station is strictly a turbine plant containing one 9000-kw Curtis turbine, one 6000-kw and one 5000-kw Allis-Chalmers turbines and one 7000-kw Westinghouse unit. Each turbine is fitted with a surface condenser outfit, the circulating water for which is taken from the East River through a concrete tunnel extending the length of the turbine room. The discharge is returned to the river by a tunnel located directly over the top of the intake tunnel. The circulating pump has only to overcome the resistance in the condenser tubes. Each condenser has a dry-vacuum pump for removing the air and on the bottom of each condenser is a hot well for collecting the water of condensation. An hourly record is kept of the steam pressure, the inlet steam pressure, the vacuum and temperatures, and the number of hours each turbine is in service.

The method in starting one of the main generator units is as follows: First, the air siphon on the circulating pump and the condenser is started. This creates a vacuum in the circulating pump and the water space of the condenser, allowing the water to flow from the intake tunnel through the circulating pump and into the condenser. The circulating pump is then started, which forces the water through the condenser. The auxiliary oil pump is now started, causing a circulation of oil through the main bearings and to the governor of the turbine. The next step is to open the throttle on the turbine enough to allow a small amount of steam to flow through and heat it up. This process is continued from 30 to 45 minutes, after which the turbine is given steam enough to revolve from 50 to 75 turns per minute for a period of five minutes. This is done so that the spindle and casing of the turbine may be heated up evenly and expanded alike around the entire circumference. The throttle is then shut, allowing the turbine to come to rest. When it is required for service, the switchboard attendant on the gallery notifies the engineer by proper signals. The engineer then starts the turbine and allows it to come rapidly up to speed. At the same time the pump oiler starts the dry vacuum and hot-well pumps, so that when the turbine is up to speed it has its full vacuum. The water is then turned on to the glands and the oil cooler, through which the oil from the bearings circulate.

The turbine generator is then ready to be synchronized with the system, which is done by the switchboard operator. As soon as the generator is synchronized and the switch closed, the engineer is given the "O. K." signal whereupon he opens the throttle wide. The turbine is then on the system. From this time on, the attention required is that the bearings be examined every 15 minues for heat, and the temperature of the discharge oil from the bearings noted, and at the same time the pump oiler makes an inspection of the bearings on the auxiliaries and the height of the water in the hot well. The assistant watch engineer looks after the turbines and the auxiliaries to make sure that the oilers attend to their duties. This leaves the watch engineer free to look after the plant, and he is directly in charge of all steam operating men. When the load is such that it requires two turbines, the third unit is kept hot and the auxiliaries running, so that it may be put on the line in from one to three minutes.

The operation of the three-phase transmission system is controlled by a system operator who directs its general operation and keeps a load curve showing the output of the generating apparatus, noting all changes in operating conditions both in the generating and substations. He has before him a dummy board of the system, with switches and buses, and his miniature switches agree in position with the actual connections to the various apparatus.

A. I E. E. PAPERS AND DISCUSSIONS

Following are abstracts of some of the papers presented last week at the Jefferson convention of the American Institute of Electrical Engineers, together with brief summaries of the discussions to which they gave rise. The papers here given were among the more practical ones read, and are not printed in the order of their presentation; those bearing on the same general subject follow each other. An account of the proceedings of the convention in detail is printed elsewhere in this issue.

OIL SWITCHES.

In a paper entitled "The Modern Oil Switch, with Special Reference to Systems of Moderate Voltage and Large Ampere Capacity," Mr. A. R. Cheyney, of the Philadelphia Electric Company, related experience with oil switches designed for e.m.fs. not exceeding 13,000 volts and currents up to 3000 amp. The author stated that experience has frequently demonstrated that no modern circuit-opening switch operating under short-circuit conditions is entirely safe to be used again without a thorough overhauling of the contacts, cleaning up of the switch and its compartments, on account of the large amount of oil which has been blown out by the explosive pressure of the arc, and also the refiling of the switch cylinders. It is frequently necessary to insert an entirely new set of contacts and to file down the rod tips. This whole operation involves a period of at least two hours, and if spare feeders are not available may lead to considerable annoyance, while, in any case, it may involve a temporary disablement of a large and important investment in apparatus.

Changes, such as the substitution of steel for brass pots, the addition in some instances of insulating dashers to assist in keeping the oil within the pot and also to facilitate the breaking of an arc, and improved operating mechanism and contacts, cover practically all the main points that have been improved upon since the introduction of the 8-in. cylinder 8 or 10 years ago, notwithstanding the enormous increase in maximum short-circuit output of the turbo-generator over that of the engine-driven alternator of equal rating and the fact that the size of units has increased from 5000 kw to 20,000 kw. The substitution of boiler-iron tanks for wooden tanks and the gravity opening, with a means of obtaining a certain forced oil flow across the contacts on opening the switch, are a few of the changes in another type.

As a matter of record, with 15,000 kw of turbines in service, the latest type of oil switch has been quite recently practically emptied of its oil, the remaining oil being reduced to a state of absolute blackness and the contacts and rods so badly burned that they were unfit for further use without renewing, makes it evident that some change is needed in our present switchboard or switch design.

Although there has not been a great deal written upon the exact nature of what takes place when a heavy arc is broken, experimental evidence has shown that the quality of the switch oil will without doubt play a very important part in the switch of the future. The electrostatic stress set up between two charged conductors in a light mineral oil such as is used in switches and transformers will, under proper conditions, even though there is no appreciable current, release considerable quantities of gas without appreciable change in the oil itself, and as this gas is naturally rich in hydrogen, it may be that the explosive violence of some of the short-circuits is due to the combination of this gas and the gas driven off by the heat of the arc with oxygen, possibly of the air. The carbonization which took place when a heavy short-circuit was broken in a certain case was sufficient to make a deposit on settling of 0.38 in. in a 4-in. column of oil, or a total volumetric proportion of 10 per cent between the amorphous carbon and the clear oil above.

Whether or not the changes in an oil produced by carboniza-

tion under heavy arcing improves or reduces the values of the remaining filtered oil for use in oil switches, it seems quite urgent that oil for switch purposes be chosen with great care, and manufacturers should make public satisfactory specifications to cover such oils and the testing of the same. It is by no means certain, as is frequently claimed, that a good transformer oil will make a good switch oil. Carbonization under heavy arcing is undeniably unavoidable.

There has been developed, although apparently it has never yet been introduced as a commercial article, an oil switch in which the oil is at all times under pressure which is maintained by a compressed air system—a pressure line at perhaps 150 lb. to 200 lb. caring for a number of switches, and a gravity or return line returning the discharged oil to the system. This principle seems to be exceedingly promising insofar as breaking the arc is concerned. In some cases the switch cylinders are always full of oil under pressure, the opening of the contacts allowing a heavy stream of oil to be forced directly across the arc and through the hollow contact to atmospheric pressure. In another case, the tripping coil opens an oil valve which admits large quantities of fresh oil under pressure to come into direct contact with the heated terminal directly at the base of the arc. It is undeniable that the mechanical squeezing out of the arc is what is needed.

The author stated that experience has demonstrated that constant vigilance is necessary with regard to every part of a generating system if service conditions are to be maintained at the highest point of reliability. Especially is this true of the oil switch in large systems. Certain defects can be noticed by visual inspection; others require the operation of the switch one or more times, while the inspector closely watches the mechanism and tanks. Still others can only be found by actually taking the switch apart and reassembling it. The inspection necessary, therefore, covers the knife switches, the insulators and contacts, oil-switch mechanism, tanks, rods, base insulators and compartment. In order best to accomplish this work the switches should be inspected daily, weekly and yearly.

The daily inspection of mechanism covers the tightening up of possible loose nuts, etc., general cleaning of switch, and all that can be observed with a reasonable amount of attention while the switch is in service, and should be given to every switch whether carrying current or "dead."

The weekly inspection covers the operation of the switch from four to six times to observe clutch conditions, tripping coils or contacts, open-circuits in wiring, loose parts, bolts, nuts, etc. This test also insures the switch being securely bolted down to its compartment.

Once a year every switch should be completely taken down, each part cleaned and oiled, contacts brightened, supplied with fresh oil, and any minor defects that may have crept in should be remedied as far as possible.

The daily inspection eliminates the minor troubles apparent to a trained observer; the weekly inspection makes it possible practically to eliminate all external troubles in the switch compartments and in the mechanism, and especially failures to operate when called upon, whether due to open tripping coils, defective clutch coils or otherwise, and practically insures the switch against trouble due to pumping; while the yearly inspection cleans up the switch as a whole, making it possible to start a new year with switches fresh and complete from top to bottom.

In conclusion the author said that the present state of oil-switch development with especial regard to its continued use in the large installations of the future has not given the operating man quite the same vision of perfect security and unlimited capacity as he would desire. There is need for a more powerful switch which will stand up in continuous service for at least a year without the necessity for overhauling every time a short-circuit is opened.

DISCUSSION.

Mr. William I. Donshea, of the New York Edison Company, said that 450 oil switches in regular service have been found to open the circuit without failure and without causing damage to the apparatus to be tested. The switches are kept in as nearly perfect condition as possible, even the oil being renewed after each opening under load.

Mr. P. Junkersfeld, of the Commonwealth Edison Company, of Chicago, related his experience with more than 200 oil switches, showing the switches do not give entirely satisfactory service on account of their inability to withstand the treatment to which they are subjected under short-circuit conditions. In order to obtain reliability in performance it is necessary to expend a large amount of money in an elaborate array of switches and emergency devices. When present types of switches are installed use should be made of reactors to cushion the blow on the switches. What is urgently demanded is a new design of switch for the severe service conditions now encountered.

Mr. F. W. Harris, of Pittsburgh, admitted that switches intended for controlling as much power as 10,000 kw in a single unit are not reliable; they never fail to open the circuit when kept in proper condition, but often are damaged during the period of opening a short-circuit. A difficulty which the manufacturer has met resides in the impossibility of testing such switches under short-circuit conditions, as no manufacturer is willing to produce deliberately a direct short-circuit on a 10,000-kw generator. For the operation of such a switch a solenoid is preferable to a motor.

Mr. C. W. Stone, of Schenectady, said that a switch cannot be designed to open a circuit instantaneously with absolute accuracy, even if it were desired to obtain one for doing so, and hence some damage may always be expected. For the purpose of minimizing the current on short-circuit use should always be made of reactors when the concentrated power exceeds safe limits. He claimed that the motor-operated type of switch is preferable to the solenoid type by reason of the greater certainty of opening; it can be so arranged as to open positively even when the source of supply to the motor is interrupted.

Mr. D. B. Rushmore, of Schenectady, called attention to the fact that the performance of oil switches in regular service is highly satisfactory, while even under extreme emergency conditions there have been almost no failures. The damage produced has been to the switch itself, rather than to the apparatus which the switch is supposed to protect.

Dr. C. P. Steinmetz stated that oscillographic observations of oil switches shows that the circuit is always opened at the zero value of current, at which time the voltage is usually quite high. The arc produced in the oil as the switch is opened generates an enormous local gas pressure by reason of the relative slowness of the oil-mass to take on motion. This pressure has been known to exceed 2000 lb. per square inch.

PHOTOMETRIC STANDARDS.

Dr. E. B. Rosa and Mr. G. W. Middlekauff, of the Bureau of Standards, discussed the properties of carbon-filament incandescent lamps which render them advantageous as photometric standards.

The authors stated that there are two kinds of primary standards employed in physical measurements, namely, those which can be described in such terms that they can be accurately verified or reproduced from their specifications, and those which are more or less arbitrary and which cannot be reproduced except by copying other standards of the same kind. Primary photometric standards may be of the first kind or of the second kind. Although primary standards of the first kind are to be preferred, *other things being equal,* obviously a reliable, convenient and permanent standard of the second kind is better than an unreliable, inconvenient and ephemeral standard of the first kind. Many primary photometric standards of the first kind have been proposed and a considerable number have been used. The flame standards are not permanent, but ephemeral, and the greatest difficulty in the use of such standards is not the lamp, which is merely the instrument in which combustion takes place. The greatest difficulty is to secure uniform fuel and uniform atmospheric conditions, and as considerable fluctuations in both are inevitable, one is driven to taking many observations and averag-

ing out the errors as far as possible by taking the mean. The other reproducible standards that have been proposed are even less satisfactory than the flame standards.

The most successful photometric standards of the second kind are carbon-filament incandescent lamps, which have been employed for many years as convenient working standards, and in recent years have been employed in making careful comparisons of the photometric standards of different countries. Such lamps cannot, of course, be made accurately to specifications, but if they are sufficiently permanent they may be employed to maintain the unit of light for an indefinite period. Work done at the Bureau of Standards tends to show that carbon-filament lamps when properly made and carefully seasoned are remarkably permanent and reliable, and that a single group of lamps might serve to maintain the units of light for a century, provided they are protected from violence and used with ordinary care as primary reference standards, even though burned as much as half an hour at a time every six months for the entire 100 years.

The above conclusions have been based on refined measurements made with potentiometers having a sensibility of 0.01 volt when using 100 volts and ammeters capable of measuring current to the fifth significant figure.

As to the precision of photometering carbon-filament lamps, photometers are now available with such a precision that the mean error of the determination of candle-power on any lamp at one time need not exceed 0.2 per cent, whereas the mean error of the average value of six lamps photometered at one time may be less than 0.1 per cent. If a group of six lamps be photometered by four different experienced observers, the mean of the four will, of course, be still less in error. These figures are the results of a large number of experiments with rotating standards, of the same color, and stationary standards may be measured with substantially the same accuracy.

With such precision of measurement and a life performance of standards such as is readily obtainable, it would seem as though the unit of candle-power not only of a commercial laboratory, but also of a national standardizing laboratory, or even of a group of national standardizing laboratories, could be maintained for a long period of years by carbon-filament incandescent lamps far more constant than could possibly be done with flame standards or any other form of primary standard as yet proposed.

DISCUSSION.

Dr. C. P. Steinmetz outlined the history of the development of the standards of length, resistance, current, etc., and showed that similar history relating to the standard of candle-power is now being made. It is essential to obtain as the final standard one that can be described in such terms that it can be accurately reproduced at any time. Incandescent lamps as standards, although very convenient, possess the undesirable feature of drifting or changing slightly in candle-power with time. The drifting tendency should be absent in a reliable standard.

Dr. A. E. Kennelly, of Harvard University, stated that even with their imperfections, the incandescent electric lamp standards are far more precise than any flame standard of candle-power.

AUTOMATIC TELEPHONY.

In a paper entitled "Telephone Engineering Around the Golden Gate," Mr. Arthur B. Smith, of the Automatic Electric Company, described the automatic telephone exchanges installed in Oakland and San Francisco, Cal. In Oakland there are five offices, designated as A, B, F, and district stations 1 and 2, while in San Francisco there are four offices, C. J. M and S. The offices are designated by letters instead of figures, the numbers relating to subscribers' stations served from the various offices. The manipulation of the dial on the calling subscriber's instrument for an average call number takes about five seconds, after which the bell of the called station begins to ring without further action on the part of the calling subscriber. The ring is intermittent and ceases when the called subscriber answers. Instantaneous release of the switches is effected by hanging the receiver on the hook. This is of interest chiefly to those who have two or more calls to make in succession.

The author described in detail the methods for handling interoffice trunk calls, suburban and long-distance calls and for collecting the charges for each call. The Oakland exchange is operated on the flat-rate basis for all calls originating and terminating within the exchange, which includes the suburb of Berkeley. In San Francisco measured service is required, use being made of an automatic two-coil meter attached to the line switch, so arranged that when the called station answers, the current supplied to the latter operates a relay which reverses the current supplied to the calling line. This causes the meter to record one call. Neither coil alone will cause registration, and the apparatus has a range from 0 to 1500 ohms line resistance. Its line coil is of low resistance and is short-circuited during conversation. The reversal of current for operating the meter is accomplished in such a manner as not to cause inconveniences to the calling subscriber.

The larger proportion of the calls between the two cities are handled on the credit basis. From the records of the toll tickets statements are made out at regular intervals and sent to the subscribers for payment. For such public places at which it is desirable to collect cash for suburban and long-distance service, a regular coin box is attached to the telephone. The dropping of the coin gives a signal which reveals its denomination to the operator.

There was no discussion on this paper.

AMERICAN TELEGRAPH ENGINEERING.

A paper by Mr. William Maver, Jr., of New York, and Mr. Donald McNicol, of Salt Lake City, recorded some of the salient features of present telegraph engineering practice in America. The authors stated that as a source of e.m.f. for telegraph service gravity batteries have been almost entirely displaced by direct-current generators, operating either alone or in connection with storage batteries. Some use is also being made of electrolytic rectifiers for charging the batteries from alternating-current circuits.

In many cases Morse duplex circuits, or portions of them are used simultaneously as telephone circuits, the wires of two such duplex telegraph circuits being employed as one metallic circuit for telephonic purposes. The Wheatstone bridge method of rendering the polar relays irresponsive to the home pole changers is used, the arms of the bridge being formed of a double retardation coil, which is found to be an efficient, practical device. Composite circuits are employed in this country and Canada very extensively, notably by the American Telephone & Telegraph Company, also by the telegraph department of large railway systems. Between New York and Boston alone at least 50 leased telegraph wires are in daily operation on long-distance telephone circuits, and this dual use of circuits is being rapidly extended in telegraph practice, all new line constructions are being designed with this end in view, the increased earning capacity of the wires gained thereby being the obvious incentive thereto.

At the present time the tendency of American practice is to the employment of lower e.m.fs. at the terminals of the circuit and to lower resistances in the relays for multiplex working. During the period when No. 9 iron wire was the standard for telegraph purposes, and when the insulation resistance of the lines was far below present-day standards, a high e.m.f. was necessary in order to maintain proper current values, but by the substitution of low-resistance copper conductors in place of iron wire and with improved line construction, the way has been paved for the employment of lower voltages, and relays of much reduced resistance in multiplex operation. Thus some very satisfactory results have been obtained recently in different parts of the country on quadruplex circuits using e.m.fs. as low as 200 volts on well-insulated lines of comparatively low resistance (2 ohms per mile) and with polar relays wound to 100 ohms and neutral relays to 50 ohms. The length of the cores of these relays has been somewhat increased. The "potential" resistance of 600 ohms (usually inserted between the current generators and the multiplex apparatus) in

these instances has also been reduced to 300 ohms, and the "proportion" resistance and "leak" shunt in the field key system from 1200 ohms to 600 ohms, and from 900 ohms to 450 ohms, respectively. The objective in these modifications of the prevailing practice is to reduce the inductive effects upon parallel circuits and to render the relay less sensitive to inductive disturbances from any source.

DISCUSSION.

Mr. R. W. Pope, of New York, called attention to the noteworthy fact that, although numerous rapid telegraph systems have been devised and installed, the manual Morse sender and receiver have survived all attempts to overthrow and remain the accepted standards for service. Manual sending with the old-type key corresponded in speed with the ability of the receiving operator to write out the message by pen. With the adoption of the typewriter for transcribing a higher sending speed is possible, and for this purpose the Martin mecograph, which makes all dots automatically, but requires manual operation for the dashes, has proved well suited. However, high-speed machine telegraphy may prove excellent for transmitting "night lettergrams."

Mr. J. B. Taylor, of Schenectady, remarked that telegraphic service means much more than the mere sending of a message at the greatest rapidity between two telegraph offices. The message must be delivered to the proper person in a form suitable for conveying to him the desired information. The necessity for writing out the received message and delivering it at any one of many thousand out-of-the-way places has been the prime reason for the retention of manual telegraphy. All of the disturbance to telegraphic circuits caused by neighboring transmission lines could be effectively eliminated by substituting metallic circuits for the ground-return circuits now universally employed.

Mr. W. B. Hale, of Mexico City, outlined the telegraphic methods employed by the Mexican governmental system. This system is operated without any attempt to obtain a profit on the investment, but rather as a service for the people. The consequence has been that messages of congratulation and those of a social nature are usually sent by telegrams in Mexico. The Government has placed on sale telegram-cards costing 5 cents upon which a message of 10 words may be written for transmittal anywhere within Mexico City. These cards are deposited in boxes and collected at one-half-hour intervals for transmittal by Government employees.

BALL BEARINGS FOR STREET CARS.

Mr. Cyril J. Hopkins, of the Hess-Bright Manufacturing Company, presented a paper calling attention to the saving in energy consumption that may be obtained by equipping cars with ball bearings and operating them on a schedule allowing considerable coasting.

The author stated that in the case of a plain bearing car making a run of 2900 ft. in 82 seconds without coasting the car consumes 110 watt-hours per ton-mile. By allowing 83 seconds for the run, a 16-second coast is admissible and the energy consumption is reduced to 94 watt-hours per ton-mile. By allowing 84 seconds for the running time the energy consumption is reduced to 88 watt-hours, which can be further reduced to 75 watt-hours by equipping the car with ball bearings, the coasting period being extended thereby from 24 to 35 seconds.

In addition to the saving in energy obtained by using the ball bearings, the author claimed for them increased comfort to passengers and decreased maintenance charges on brakes and motors.

DISCUSSION.

Mr. A. H. Armstrong maintained that when the bearings on a car are changed from the usual cylindrical to the ball type there should be a corresponding change made in the gear ratio if the results obtained with the older arrangement is to be compared with that obtained with the newer one.

Mr. N. W. Storer remarked that not all of the energy saving reported by Mr. Hopkins should be attributed to the ball bearings, because much of it was due to the change in the coasting conditions.

Mr. H. S. Putnam said that the mere substitution of ball bearings for bearings of the ordinary type could not produce so great a saving as claimed by Mr. Hopkins since he had claimed a possible reduction in the tractive resistance of 8 lb. per ton, since bearing friction alone is not so great as this amount.

Mr. F. J. Sprague ventured the prediction that within a few years ball bearings will be quite generally adopted for railway cars.

ENERGY FOR OPERATING RAILWAYS.

Mr. H. St. Clair Putnam presented a paper describing some tests made on the Manhattan Elevated Division of the Interborough Rapid Transit Company, New York, in which a clock was used to record the amount of coasting employed in the operation of trains, the object of this device being to obtain from the motormen a better manipulation of the trains with the resulting economy in the consumption of energy.

The clock used in the tests consisted of a mechanism manufactured for factory and office use for recording the time of employees. To the balance-wheel escapement there was added a braking device which is lifted free from the balance wheel by an electromagnet which is energized only during the coasting of the train. This permits the clock to record the coasting time only. Each motorman's service is rated according to the percentage that the coasting time is of the total time of the run.

The object in employing the clock is to encourage the motorman to accelerate the trains at a high rate and lose less energy during the braking period. It was estimated that under the Manhattan Elevated conditions, providing other factors of train operation remain the same (that is, the braking, running time and time of stop), an increase in the rate of acceleration from 0.9 mile to 1.47 miles per hour per second will result in an increase in the percentage of coasting time from 0 per cent to 40.5 per cent of the total time, and a saving of 36 per cent in energy consumption.

As a result of operation with the coasting time clock it was found that an increase in the percentage of coasting from 12 to 37.5 effected a saving in energy consumption of 24 per cent. The author claimed that it is preferable to measure the time of coasting rather than the amount of energy actually consumed, since coasting represents the recovery of energy already used and is the key to the whole problem of economical operation. At the same time it concentrates the motorman's attention on that element of operation which is the direct reason for the saving in power which results from changes in the methods employed as to the other factors of operation.

DISCUSSION.

Mr. A. H. Armstrong, of Schenectady, called attention to the increase in power involved in saving energy by coasting, and stated that an increase can be made in the acceleration without increasing the maximum power demanded from the station by accelerating at a more rapid rate with the motors in series while maintaining the former rate of acceleration during parallel running. Thus a 100 per cent increase in the current per motor, while in series, would be needed in order even to equal the power demand with the motors in parallel.

Mr. N. W. Storer, of Pittsburgh, remarked that the coasting time clock insures the proper manipulation of the controller to a much greater degree than is possible when the motormen are merely instructed as to the methods to be employed for saving energy.

President L. B. Stillwell pointed to the absurdity of demanding from the manufacturers machines giving efficiences of almost 100 per cent and then carelessly losing 24 per cent of the generated power by improper operation of the cars. He estimated that the saving produced by the adoption of the coasting-time clocks on the Second Avenue division of the New York elevated roads is equivalent to $1,000 per day.

Mr. Frank J. Sprague said that for the purpose of insuring uniform accuracy in acceleration the automatic equipment,

which renders the rate of acceleration independent of the motorman, is far preferable to the manually controlled equipment.

Mr. G. H. Hill, of Schenectady, discussed the habit of many motormen of applying the brakes long before reaching a station, thereby necessitating extra energy for bringing the train to the platform. He said that much energy could be saved by equipping the cars with automatic devices for controlling the retardation during the braking period.

In answer to a question by Mr. J. B. Taylor, Mr. Putnam stated that the coasting-time clocks are so installed and operated that a motorman is unable to obtain a false record, assuming that he wished to do so.

MECHANICAL FEATURES OF ELECTRIC LOCOMOTIVES.

Messrs. N. W. Storer and G. M. Eaton, of the Westinghouse Electric & Manufacturing Company, presented a paper containing a discussion of the essential features of an electric locomotive. Among these are: (1) Mechanical parts of strength sufficient for the required service; (2) motors of sufficient size to develop the required power; (3) a reliable transmission system between the motors and the driving wheels; (4) weight on driving wheels sufficient for adhesion; (5) a complete control system; (6) riding qualities enabling the locomotive to negotiate the rails without undue damage. More or less closely associated with these essentials there is an endless variety of detail concerning which no two men will hold identical opinions. The electric locomotive designer must act as a clearing house for the opinions and ideals of all the men associated with railroad electrification. To prepare himself for this position, he must view the locomotive through the eyes of men connected with every branch of the service.

The authors outlined the conflicting requirements for switching service, slow-freight service, fast-freight service, and high-speed passenger service, and stated that while it is commercially practicable to cover a considerable range of speed and weight of trailing load with one locomotive, and any passenger locomotive may be used to handle on its lower speeds freight trains within its range of tractive effort, yet where the weights of trains to be handled and the speeds at which they operate vary as widely as they do on most trunk lines, an absolutely interchangeable locomotive is impracticable.

The electric locomotive is not so well suited for interchangeable service as is the steam locomotive because of the fact that its continuous tractive effort is practically constant regardless of the speed at which it is operated. A steam locomotive, on the other hand, can develop its maximum horsepower at almost any speed, and its continuous tractive effort may be anything from its maximum, which is developed at starting, down to that necessary to give its maximum horsepower at its maximum speed. It may be contended that where gearless motors are used it is simply a matter of winding the motor to develop a given tractive effort at its maximum speed, and it will then be suitable for any service requiring this tractive effort at lower speeds. This is true, but for mechanical reasons the converse is not true; namely, that a freight locomotive can be operated in passenger service by winding the motors for a higher speed. An economical mechanical design for a locomotive, which is thoroughly satisfactory for freight service, will not be at all suitable for the high-speed passenger service. Steam locomotives have been used interchangeably to some extent in railway service, but in general this has been found impracticable.

In discussing transmission through gears, the authors remarked that gears can be obtained to perform satisfactorily in any class of railway service. They said that while it is too early in the use of gears for large locomotives to make an absolute statement of fact in regard to the allowable pressure, experience thus far indicates a pressure of 1000 lb. per inch width of gear face as a perfectly practicable value for continous rating of large gear. With special steel pinions and high-grade gears it is probably safe to exceed this figure. It is well known that for short hauls pressures far above 1000 lb. per inch are now in daily successful operation. In the locomotives for the St. Clair tunnel, for instance, the pressure is carried on a single gear having a 6-in. width of face. The normal loads at which the locomotive operates on the up-grade give a pressure of from 1500 lb. to 2000 lb. per inch width of face on the gears. With this pressure the pinions have a life of from 40,000 miles to 50,000 miles, and none of the gears has yet worn out, although the locomotives have been in continuous operation for over two years. With twin gears there is a possibility of further increase in unit pressure as the absence of relative skewing of pinion and gear shafts produces a better application of the tooth load.

Transmission by side-rods possesses some very distinct advantages. It permits the use of a single powerful motor to drive two axles. The motor is mounted in the cab instead of under it, so that all parts are readily accessible and are thoroughly protected from dust, dirt and water from the roadbed. The location of the heavy motor so high in the cab raises the center of gravity of the locomotive to a height corresponding to that of high-speed steam locomotives. The side-rods form a transmission system that is familiar to all steam-locomotive operators. It apparently has all the good points of the steam locomotive rods and is, in addition, susceptible to perfect mechanical balance and gives a uniform tractive effort.

The side-rod type of locomotive is at a disadvantage when compared with the high-speed geared type, because of the fact that the mechanical parts of the locomotive and also the motor frames must necessarily be much heavier to withstand the reciprocating stresses imposed on them. They will also require much more careful work in assembling, and will, therefore, be more expensive. On the other hand, it would seem that after the side-rod locomotive is once completed the mechanical parts should be very cheap to maintain.

DISCUSSION.

In introducing the discussion on Mr. William McClelland, the chairman of the railway committee of the Institute, outlined the fundamental difference between the problems encountered in designing steam and electrical locomotives. The most prominent difference relates to the thermal problems. With the steam locomotive it is desirable to maintain a high temperature, while with the electric locomotive it is best to keep the apparatus as cool as possible.

Mr. A. F. Batchelder, of the General Electric Company, claimed that in the design of switching locomotives it is not essential to obtain the minimum possible dead weight per axle, this feature being of relatively minor importance. Moreover, the necessity for high center of gravity has been much exaggerated. The desired results can be obtained by placing the supporting springs near together rather than far apart. The permissible weight per axle is not set by the whim of the operating men, but is determined by the condition of the track and the strength of the bridges. An excellent design consists in placing the weight near the center of the locomotive and employing such an arrangement as most readily to steer the mass in the direction of travel. Mr. Batchelder showed a recent proposal for embodying all of the desirable features in an articulated symmetrical electrical locomotive in which use is made of both gears and side rods, the center of gravity being only moderately high.

Mr. Frank J. Sprague, of New York, argued that the prime requisite is a locomotive having good riding qualities which can be produced at the minimum expense. Of the three principal types, exemplified in the gearless directly mounted New York Central locomotive, the gearless spring-mounted New Haven locomotive, and the side-rod Pennsylvania locomotive, the first named is much the simplest. There is no absolute necessity for a high center of gravity, the chief desideratum being obtained by making each wheel independently movable in the required directions. Mr. Sprague stated his positive conviction that the New York Central accident was not caused by the low center of gravity of the locomotives, as shown by the fact that the locomotives have been rendered thoroughly safe without changing the center of gravity by merely adding guiding trucks.

Mr. A. H. Armstrong, of Schenectady, claimed that service requirements under steam railroad conditions may render it necessary to use electric locomotives interchangeably for freight and passenger haulage over grades. A solution of such a problem might be found in employing, say, three locomotive units for hauling a freight train at moderate speed and one unit for a passenger train running at higher speed.

In closing the discussion, Mr. G. M. Eaton stated that he had made close personal observations of the riding qualities of the various electric locomotives placed in service around New York, and had found that, although the New York Central locomotive operates with a high degree of satisfaction at low speeds, it possesses a decided tendency to "nose" when running at high speed; that is, it tends to spread the rails under this condition.

LOCOMOTIVE HEAD-LAMP TESTS

A paper by Profs. C. Francis Harding and A. N. Topping, of Purdue University, contained reports of results of road and laboratory tests on the effect of powerful locomotive head-lamps upon the interpretation of signals and upon the ability of the engineer to see and recognize obstacles upon the track in front of the locomotive. The road tests were carried out on the St. Louis division of the Big Four Railroad for the purpose of comparing effects noted above of oil and electric head-lamps under actual operating conditions.

The laboratory and out-of-door tests were carried on to determine the photometric and spectrophotometric values of the above head-lamps as well as corresponding values for reflected light from signal roundels.

The road tests showed: (1) That a powerful head-lamp on a locomotive has one marked disadvantage, namely, that it causes reflections from glass roundels and lenses, thereby producing false or phantom signals. It seems likely that these are partly due to the intensity and partly to the spectral composition of the light. (2) That a powerful opposing head-lamp adjacent to block signals so obscures the latter as to make it difficult to read them correctly at distances exceeding 1000 ft. (3) That an opposing oil head-lamp of ordinary intensity allows such signals to be read correctly at 4000 ft. or less. (4) That even with no opposing head-lamp, the distance in which the signal can be read correctly is slightly reduced by the use of a powerful head-lamp. (5) That a more powerful head-lamp on an approaching engine obscures the classification signals on that engine to a marked degree. This is particularly true of green signals in the glare of a powerful head-lamp whose spectral intensity is high in green. (6) That an opposing oil head-lamp of ordinary intensity allows either white or green signals to be read at a distance of 400 ft. or even more. (7) That obstructions on the track cannot ordinarily be seen with a powerful electric head-lamp at a sufficient distance to prevent accidents, since a train traveling at a high rate of speed cannot be stopped in the distance at which obstacles sufficiently large to cause a wreck were first detected.

The laboratory tests were made on seven different lamps of various types, as follows: (1) Luminous arc, upper electrode copper, lower electrode presumably magnetite composition. (2) Carbon arc, carbons inclined 45 deg. to the horizontal. (3) Luminous arc, similar to No. 1. (4) Electric arc, upper electrode carbon, lower electrode copper. (5) Kerosene oil lamp. (6) Acetylene lamp. (7) Luminous arc, same as No. 1, but, instead of being fitted with a reflector, supplied with a lens. These tests showed: (1) That the magnitude of the illumination is a function not only of the total light flux emitted from the lamp, but also its distribution. (2) That the reflector in which the largest proportion of total light flux falls in the vertex will have the highest multiplying factor. (3) That the lens type of projector has a higher multiplying factor than has the reflector type, other things being equal. (4) That the spectral intensities of the luminous arc head-lamps are not noticeably different from those of the carbon arc, although the former are slightly lower in the red portion of the spectrum than are the latter. (5) That the head-lamp No. 4 having a lower electrode of copper may so operate in practice as to produce relatively high intensities in the yellow-green portion of the spectrum. This is also true of head-lamp No. 3 with terminals reversed. (6) That head-lamp No. 5 gives intensities higher in the red and lower in the green than all other head-lamps tested. (7) That the reflected light from green roundels has a higher intensity in the green than that from red roundels and that this intensity is greatly augmented when a signal lamp is placed behind the signal roundel as in practice.

DISCUSSION.

Mr. G. H. Stickney, of Schnectady, remarked that a locomotive head-lamp performs a double function in providing a warning of the approach of the locomotive and in enabling the driver to see objects on the tracks. In order to ocercome the objections of glare and reflection, the beam of light could be directed below the signals and out of the range of the driver on an oppositely running locomotive.

Dr. C. P. Steinmetz, of Schenectady, stated that since the head-lamp is intended either to be seen or to enable one to see, the more light it produces the better are the results. When it becomes too powerful for the signal lamps, the proper method is to increase the light from the latter lamps.

Mr. J. C. Lincoln, of Cleveland, Ohio, maintained that the best solution of the problem is to place the head-lamp in the proper position and then so direct the light that it does not fall on the signals.

In reply to questions by Prof. H. P. Wood and Messrs. J. B. Taylor and Harry Barker, Professor Harding said that the head-lamps give better results when placed on top of the locomotive than when placed lower down on account of the inability of yardmen to distinguish the number on the lamp when in the latter position. Although no specific tests were made with the object of determining the ability of the 11 observers to distinguish colors, the tests of the lamps furnished sufficient evidence to show that no observer was color blind. The Indiana Railroad Commission has adopted candle-power rating for head-lamps falling between the oil lamps and the electric arc lamps, namely, 1500 cp, but has not specified how the candle-power is to be measured or defined.

ELECTRIC RAILWAY SERVICE.

In a paper by Mr. R. W. Harris, of the Wisconsin State Board of Assessment, a description was given of an investigation into the adequacy of the service rendered by the Milwaukee street railway system. A study of the movement of the people showed that there are four distinct periods in each day during which the majority of people travel, namely, from 6 a. m. to 9 a. m.; 11 a. m. to 2 p. m.; 5 p. m. to 8 p. m., and 10 p. m. to 11 p. m. Observation showed that independent of the amount of available seating room, about one person out of each five is willing to stand by preference, so that a car designed for seating 42 passengers can be considered as suitable for conveying 50 passengers with the desired amount of comfort. The investigation indicated that the minimum practicable headway in Milwaukee is 20 seconds, corresponding to 180 cars per hour passing a chosen point in one direction. In cases where the number of passengers to be carried exceeded the carrying capacity of this number of cars it was necessary to re-route certain of the cars and thereby reduce the congestion over the heavily loaded sections.

The author remarked that the routing of the cars that serves the largest number of people by the most direct route, at times when the traffic requires it, free from delay and with a sufficient number of sanitary cars so the average amount of traffic will be comfortably cared for, is highly desirable. A failure to provide any one of these accommodations will result in an attack, sooner or later, on the company for giving poor service.

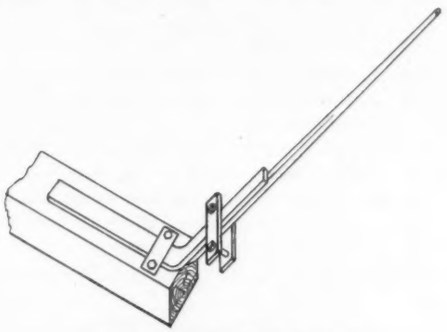
DISCUSSION.

Mr. W. E. Reed expressed the opinion that the number of passengers standing by preference in a car depends largely upon the distance to be traveled, and hence values observed in one place are not applicable in other places where the lengths of haul are different.

LETTERS ON PRACTICAL SUBJECTS

A METHOD FOR BENDING BUSBARS.

The writer has had considerable work to do on various sizes of copper busbars. As far as possible, lengths of approximately 20 ft. were used as, of course, the longer the individual bars the smaller the percentage will be that is wasted in the laps. Copper busbars of this length are quite difficult to handle and to bend with any degree of accuracy without special apparatus. In doing this work the writer has found a comparatively easy and simple way to bend the busbars. This consists in using a piece of timber about 6 in. or 8 in. and perhaps 16 ft. long, and arranging a clamp at one end made up of a piece of flat iron and a couple of bolts passing through the timber. The busbar is secured under this clamp within about 2 in. of where the bend is desired, and a pinch bar is clamped to it as shown in the accompanying illustration. With this



Method of Bending Busbar.

apparatus the busbar can be bent with a fair degree of accuracy to any angle desired. Before making a bend a wire can be bent to the correct angle and then used as a templet in bending the busbar. To put a quarter twist in a busbar, the latter is clamped and a pinch bar is clamped to it at right angles to the length of the busbar and the busbar twisted. In a 2½-in. x ½-in. copper busbar a quarter twist can be made in about 6 in. of length without forging. A short bar can probably be handled to better advantage in a vise. To bend a bar on its edge it is generally necessary to send it to a forge shop and to make the bend while the bar is hot, since it is difficult to make the busbars stay flat otherwise.

Niagara Falls, N. Y. J. CLOYD DOWNS.

REMARKABLE ELEVATOR ACCIDENT.

Two electricians were at work recently in the shaft of an electric elevator in a State Street building in Chicago. They were standing on the top of the car and were installing conduit for new mains for the elevator motor and for lamps. The foreman on the job was inside the car, and with him was the colored elevator operator. In some manner, unexplained at the time, there was a short-circuit in the shaft, followed by a flash of fire and the dropping of sparks down into the car. The foreman hurriedly left the elevator, and he was followed by the elevator man. In the excitement, apparently, the controller handle was pulled over, so that the car shot up toward the top of the shaft. One of the electricians on the roof of the car jumped for an open gate as the car was passing an upper floor, but his attempt was unsuccessful, and he was caught between the car and the opening in the shaft, receiving injuries from which he afterward died. The other man was rescued without injury, as the car stopped when the first man became jammed in the opening.

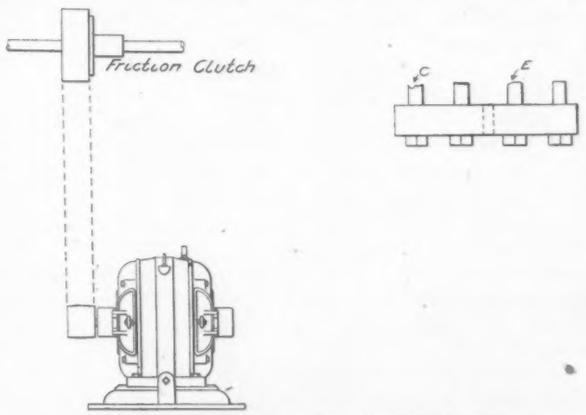
On investigating the accident later, inspectors from the city Department of Electricity were for a considerable time unable to locate the cause of the accident. It was finally discovered, however, that the direct cause of the trouble was a short-circuit between the steel elevator control cables and the grounded metal enclosure on the main floor. The more remote cause of the accident, however, was of quite unusual interest. A breakdown of the fiber insulation of the reversing switch in the penthouse, containing the electric elevator motor and controlling mechanism, caused a connection with the metal parts of the machinery, and also the large I-beam to which the motor is bolted. This I-beam also supports the penthouse. This made all metallic parts of the elevator car and cables, as well as the machinery on the roof, "alive," exhibiting a difference of potential to ground of nearly 120 volts. The metal sheaves of the controlling cables are mounted on wood. The penthouse is wood, covered with metal sheeting outside. No part of the metal sheeting was in contact with the I-beams. The controlling cables show burns caused by the short-circuit, and they are fastened, but not securely, to an angle-iron at the bottom of the shaft. It was found that all metal work here was covered with rust.

Voltmeter readings showing that the metallic parts and the elevator mechanism were grounded in the manner indicated were taken from the motor base to a radiator ground while the motor was in operation. With the car ascending, the reading was 119 volts, and with the car descending, it was 94 volts.

Chicago, Ill. JAS. L. CUTHBERT.

TROUBLES WITH INDUCTION MOTORS.

Motors are very frequently installed in manufacturing plants in such a manner as to cause considerable trouble and annoyance, not to mention frequent shut-downs. One not infrequently finds an induction type of motor having a squirrel-cage rotor coupled so that it will be necessary for it to start under heavy load. Aside from the injurious action of the excessive current upon the motor itself, this method of running an induction motor is detrimental to the life of the belt and the starting box, and causes much annoyance by the opening of circuit-breakers and the blowing of fuses. For instance, in the case of motors driving heavy shearing machinery, punches or devices carrying heavy balance wheels, these should first be placed into operation without load, so that the stored energy in the flywheels may be utilized when the load is thrown on. To start such machinery on the jump requires an excessive amount of energy and current oftentimes greater than that permitted by the insurance authorities for the size of wire used in feeding the motor. Many of these installations can be made to operate more satisfactorily, and require less energy at starting, by arranging the motor drive as shown in Fig. 1. Here a friction clutch is employed on the main lineshaft so that the motor may be brought up to speed before it is connected to the load. The friction clutch permits the load to be picked up gradually while the motor is running at full speed. In selecting a fric-



Figs. 1 and 2—Troubles with Induction Motors.

tion clutch one should be certain that it possesses ample capacity. Not infrequently a clutch which has ample capacity at first will not carry its connected load after long service, so that it is best to purchase one slightly larger than would be abso-

lutely necessary. It will then be found to require very little attention and give much better service than one operating up to its limit. The main feature which a friction clutch used in connection with an electric motor should possesses is ample sleeve bearing, so that it will remain true and give a good contact without slippage. It is felt that if the suggestions above are heeded burn-outs at contact points in the starting box, such as shown in Fig. 2 at *C* and *E*, will be entirely avoided. The extra current which is required in a motor of the induction type starting under full load from standstill is exceedingly detrimental to the life of contact points, regardless of the oil, and it is not long before trouble is experienced with the starting box. Unfortunately, owing to the simplicity of the induction motor they are very frequently run under unfair conditions, the most prevalent of which is that of throwing the motor on the line under load.

Sheffield, Ala. C. R. McGahey.

THE SIMPLICITY OF THE B. & S. GAGE FOR COPPER WIRE.

At first sight it would appear a hopeless task to try to remember the whole of the B. & S. wire gage, together with the resistances and weights of the various sizes. The task proves, however, to be a very simple one if approximate accuracy suffices. The numbers 2 and 5 serve, by strange coincidence, as key both to the wire table and to the constants for copper. The following table, for instance, gives, almost at a glance, the approximate resistance per 1000 ft. of any wire from No. 4-0 to No. 29. This table involves only the numbers 2 and 5, or simple combinations of them or their reciprocals:

	1/2x200	1/200	1/100	1/50	1/25	1/20	1/10	1/5	1/2.5	1/2	1/1	1/0.5	1/0.25
20....	4–0	0	3	6	9	10	13	16	19	20	23	26	29
25....	3–0	1	4	7	..	11	14	17	..	21	24	27	..
25....	2–0	2	5	8	..	12	15	18	..	22	25	28	..

To find the resistance per 1000 ft. at about 20 deg. C. of any size of wire, in ohms, multiply together the fraction at the head of the column and the number at the end of the row, in which the gage number occurs. Thus, for instance:

No. 21 wire has a resistance of about $(\frac{1}{2} \times 25) = 12.5$ ohms per 1000 ft. No. 8 wire has about $(1/50 \times 2^5) = 0.64$ ohms per 1000 ft.

The following well-known rule aids in writing out the table: *"The resistance of B. & S. gage copper wire becomes doubled every third size and multiplied by ten every tenth size."*

In order, now, to determine the diameter and other useful constants for the various sizes it is well to use No. 10 wire as a starting point.

No. 10 = (5×2) B. & S. copper wire.
100 = (5×20) mils in diameter.
10,000 = (5×2000) circular mils cross-section.
1 = (0.5×2) ohms resistance per 1000 ft.
32 = (2^5) lb. weight per 1000 ft.
500 lb. breaking weight (hard drawn).
250 lb. breaking weight (annealed.)
5 mils thickness of single cotton covering.

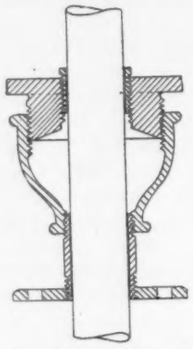
The numbers 2 and 5 help also in remembering the following constants for copper:

The atomic weight is 64 $(= 2 \times 2^5)$.
The valency is usually 2.
The specific gravity is 555 lb. per cubic foot.
The specific heat is 0.1 $(= \frac{1}{2} \times \frac{1}{5})$.
The melting point is 1100 $(= 550 \times 2)$ deg. C.
The temperature coefficient is 0.0022 per degree Fahrenheit.
The tensile strength is 40,000 = $[(200)^2]$ lb. per square inch.
In ductility copper stands fifth on the list given by the Aluminium Company of America.

Pittsburgh, Pa. F. M. Denton.

HOME MADE STUFFING BOX.

A short time ago the writer had occasion to use a couple of stuffing boxes for a 1-in. shaft, and as there did not happen to be anything on the premises that would answer, and the requirements of the job did not warrant making them up according to standard pattern, the arrangement of pipe fittings shown herewith was devised and found to work very satisfactorily. The stuffing box is very easily made up, owing to the fact that



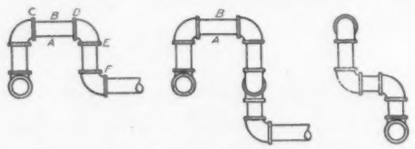
Stuffing Box Made of Pipe Fittings.

standard 1-in. pipe makes a nice working fit for a 1-in. shaft. Standard pipe fittings will do equally well on a number of other sizes of small shafting. As shown in the illustration, the articles necessary to put together such a stuffing box are: a floor flange, two nipples, one reducing coupling and one bushing. It makes a better job to use a bushing a size smaller than the shaft, and then to drill it to fit, if the proper drill is procurable.

Buffalo, N. Y. D. C. Jones.

BENDS VERSUS EXPANSION JOINTS.

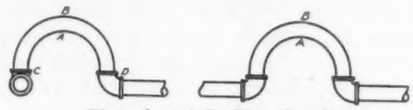
The build-up bends shown in Figs. 1, 2 and 3 have an advantage over the continuous bends shown in Figs. 4 and 5 owing to the fact that they automatically compensate for expansion and contraction by either screwing up or unscrewing in the fittings as the strain or stress is brought to bear on them, thus arranging themselves to suit the different stresses imposed. The stresses are of three kinds, namely, torsional, tensile and compressive. The torsional stress is imposed in a direction calculated to twist the pipe apart; the tensile stress is imposed on the pipe or bend in a direction the effect of which is to pull the pipe apart, while the compressive stress is calculated to crush the pipe or bend. In the bends in Figs. 1 and 4 a tensile



Figs. 1, 2 and 3—Built-Up Pipe Bends

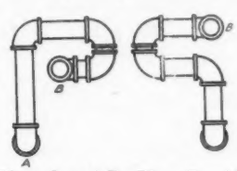
stress would tend to increase the distance between the legs of those bends, and hence the under part of the pipe shown at *A* would be under a tensile or pulling stress, while the upper portion of the pipe, shown at *B*, would be subjected to a crushing stress. The one great objection to build-up bends is the number of fittings employed and consequently the increased number of joints, with their liability to leakage. In a large number of cases the use of continuous bends tends to rupture the pipe owing to the way they are connected or inserted in the line, for the reason that the strain imposed by either expansion or contraction would tend to shear or break the bolts in the flanges when these are used as the connecting medium. This is particularly true when the flanges are permanently fitted to the bends. If the flanges were screwed on the continuous bends, as with the built-up bends, then they could swivel, thus compensating for strains. Of course, in this case the direction of strain would have to be known before the bends were connected up, and then they should be erected to allow for swivelling.

The flexibility of the bends in Figs. 1, 2 and 3 is, upon inspection, immediately apparent. The side view with the form of built-up bend, shown in Fig. 3, makes no difference how the strain is imposed; this bend will automatically arrange itself to suit the varying stresses of expansion and contraction. Two different strains could be applied at right angles to each other at the same moment and still this bend would compensate for both directions of strain, while the bend shown in Fig. 1 can only compensate in one direction. The bend shown in Fig. 1 has an advantage over those shown in Figs. 4 and 5 because it can swivel at four points, as shown at *C, D, E* and *F*, while the bend shown in Fig. 4 can only swivel at two points. It is



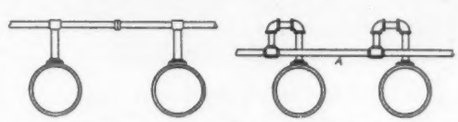
Figs. 4 and 5—Pipe Bends.

understood that the strain applied to those bends is perpendicular to the paper, and under such a stress the bend shown in Fig. 5 would not be capable of compensation, as the strain could not be applied in that direction. When the strain is applied so as to force the pipes closer together or to pull them further apart, then the bends shown in Figs. 4 and 5 are equal in efficiency to that shown in Fig. 1 in compensating for expansion and contraction. If the elbows shown on the bends in Figs. 1 and 4 pointed in the same direction as shown in the bend illustrated in Fig. 5, then there would no difference, as the tendency would be to close or open the space existing between the sides of the bends. Whenever such a stress exists in the bend shown in Fig. 2 there can be no opening or closing of this space, as the strain is compensated for by reason of the swivel-



Figs. 6 and 7—Pipe Bends.

ling of the extra joint, hence the importance of the bend shown in Fig. 2 in compensating for the push and pull incident to long lines of piping is apparent. Fig. 6 shows also a very important built-up bend used principally in places where the pipe extending from elbow *A* is rigidly situated. In this case the line of pipe connected to *B* can push or pull without doing any harm to the main line at *A*. There are so many points offered for swivelling purposes with this style of bend that the movement of the ell *B* is hardly perceptible unless the pine line is of considerable length. This bend can be employed for taking care of expansion and contraction on three main lines of piping with good results. Fig. 7 illustrates a bend used where the service main is situated above the main steampipe, as shown at *B*. It will be noticed that the bends shown in Figs. 6 and 7 are somewhat



Figs. 8 and 9—Boiler Connections.

similar in structure with the exception noted. The swivelling and compensating action of these two bends are similar and takes care of the lengthening and shortening of the supply steam lines, while the opposite bends are only used to allow for the passing of the pipe over and under obstructions. Thus in the case of the bend shown in Fig. 6, which was used in a certain place, the engineer was forced to carry the supply line under a line of water mains and in the case of the bend shown in Fig. 7 had to run under a heavy stone arch and return over the same arch. In both cases the object was to have the bends act as compensators for expansion and contraction and at the same time to permit of bringing the connections where they were wanted. Fig. 8 shows a battery of boilers connected up without due consideration for expansion and contraction. With this style of pipe fitting the strain on the bolts and flanges is multiplied whenever one of the boilers is shut down for cleaning or repairs. The rigid connection between the boilers causes trouble from leakage and difficulty is experienced in fitting gaskets to the various connections. Fig. 9 shows a much better arrangement than that shown in Fig. 8 for fitting up a battery of boilers and at the same time for allowing for expansion and contraction. The main pipe *A* is free to move from right to left or vice versa, the connections swivelling to compensate for whatever movement may occur. But in the arrangement shown in Fig. 8 there is no such movement of the steam main possible. Any expansion or contraction of the connections imparts the same stress to the boilers, causing them to recede or approach each other and hence the great difficulty in maintaining the flanges and connections steam tight. In many cases this method of connection cracks the sustaining wall around the boilers, and such cracks being usually in the outer brickwork, admit cold air, thereby causing a loss. In general, cracked walls are blamed on the furnace, there being no effort made to discover if any other cause exists.

Philadelphia, Pa. KINGSLEY WILLIAMS.

STARTING TORQUE OF INDUCTION MOTORS.

Probably the most common mistake in the installation of induction motors is the selection of a motor that is too small to start the load. Most machinery manufacturers can now give us fairly reliable data as to the power required to drive their machinery under running conditions, but few of them know what starting torque is required to start the load from rest and bring it up to speed. Some classes of machinery, such as fans and centrifugal pumps, require little effort at starting, but the load accumulates as the speed increases—other classes of machinery require practically the same effort at starting that they do to maintain their speed after in motion and some even more than this. In the latter class are pumps and air compressors starting under pressure. Elevators and hoists or other machinery that move a dead weight or pull against a fixed constant resistance and often a line shaft with many idle belts will be found to belong to the class that requires more effort at starting than after it is in motion and driving full load.

This is often the controlling feature in selecting a suitable

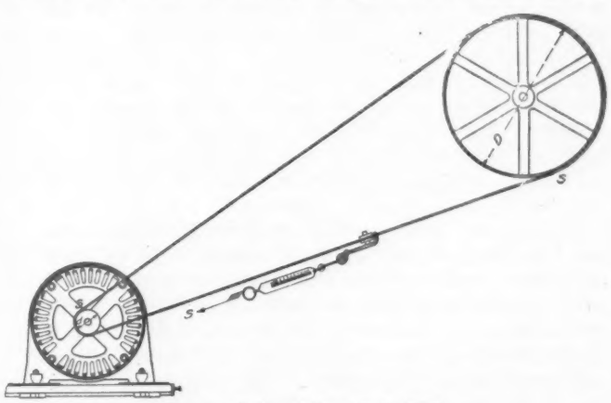


Fig. 1—Determining Belt Pull.

induction motor, for while modern motors will exert starting effort considerably greater than that corresponding to their rated horse-power, they are often found connected to loads that they will run easily after starting, but will fail to start without assistance. Very often this is due to a drop in voltage at the motor terminals on account of insufficient transformer equipment or a long supply circuit of insufficient size. This condition is readily discovered by a voltmeter, but even then the question often arises as to whether the motor is large enough if the voltage were properly maintained or how large a motor should be used. The positive determination of this

matter is so simple that it is surprising the subject is so often a matter of controversy and the method of procedure in typical cases given below is presented in the hope that resort to these simple and convincing tests will in a measure eliminate the fruitless argument that often results in such cases. Suppose an induction motor is belted to a line shaft which may drive a group of machines or a single machine through other belts, as shown in Fig. 1. It is found that the motor fails to start this load and the question arises whether the load is greater than the motor should be expected to start or whether the motor is at fault. The driven machinery may be connected or not, but with this we are not concerned, as it is the actual torque that the motor has to exert under starting conditions that is to be the subject of test. There is always some slack in the connecting belts and when the motor is started it first turns the line shaft slightly, taking up this slack, and then the full starting effort necessary to overcome the resistance of the belts and the idle pulleys will be required.

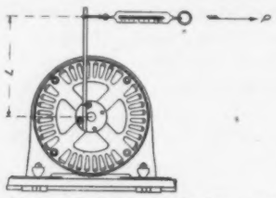


Fig. 2—Testing Motor Driving a Machine Through Coupling.

If the pounds pull the driving belt has to exert to start this shaft and machinery can be found this can easily be translated into horse-power by considering it in connection with the belt speed after the motor is running, and to find this pull one can proceed as indicated in Fig. 1. A clamp which may be made of two pieces of hard wood slightly wider than the belt, with bolts passing through each end, is fastened to the pulling side of the belt and by means of a rope fastened in a loop around the belt back of this clamp or otherwise attached to the clamp an ordinary spring balance is fastened to the belt, as shown in Fig. 1. In the case of a small motor, the clamp may often be omitted and the rope simply tied around the belt. Now, holding this balance parallel to the belt and pulling in the direction that the belt runs, we first take up the slack of the driving belts and then a further pull will start the shaft and the maximum reading of the scale will indicate the number of pounds of useful belt pull required to start the load. From the number of revolutions and the size of the pulleys we find the belt speed in feet per minute and multiplying this by the pounds pull, we have the number of foot pounds per minute, which, divided by 33,000, gives us the horse-power of the motor which will exert this starting effort without overload. For example: Suppose a pull of 60 lb. is registered on the spring balance and the driven pulley on the line shaft is 36 in., or 3 ft., in diameter, and runs at 200 r.p.m., the horse-power would be: $Hp = 60 \times 3 \times 3.14 \times 200 \div 33{,}000 = 3.12$.

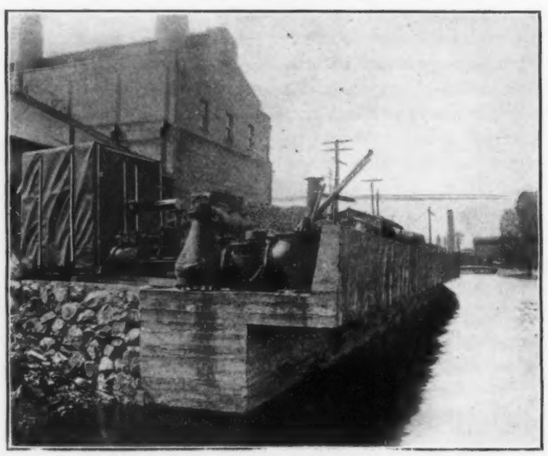
Most modern motors will exert a starting torque about 50 per cent greater than the torque corresponding to their full rated load when full voltage is impressed at their terminals, but it is often undesirable to apply full voltage on account of the heavy current that will be drawn from the line so that this excess should only be used as a margin for emergencies and with large motors it is better practice to arrange the load so that it may be disconnected at the start and not over 30 per cent to 50 per cent of full-load synchronous torque required.

In Fig. 2 is shown the method for testing a motor directly connected to an elevator or other machine that may be driven by a coupling. A bar of iron or wood of convenient length is clamped beneath the heads of the coupling bolts or may be simply hooked in place between the bolts and shaft in such a way that it serves to move the motor and driven machine in the normal direction. The motor is turned until all the backlash is taken out and it actually begins to raise the load, then a spring balance is applied at a fixed distance "L" from the center of the shaft and the pull on the balance would indicate the effort required to start the load as in the case of the belt. Care must be taken to pull in a direction at right angles to the line from the center of the shaft to the point where the balance is attached to the lever and to measure the distance from the center of the shaft to that point, then the horse-power is obtained by the formula: $Hp = 6.28$ N. L. P. $\div 33{,}000$ in which P equals number of pounds pull shown by the balance, L the distance from the center of shaft to the balance, in feet, and N, the number of revolutions of the motor per minute. In the case of a pump or other machine driven by gearing, the spring balance may be attached to the rim of the gear and pulled in a tangential direction, and the horse-power obtained by multiplying the pull by the speed of the gear in feet per minute and dividing by 33,000. This test may also be used to determine in advance the horse-power required to drive an elevator or similar machine before the installation of a motor. It is, of course, not applicable for this purpose when the load is of such character that the torque increases with the speed, but is perfectly reliable and accurate in all cases for determining the starting effort.

Chicago, Ill. M. O. Southworth.

OVERHANGING RETAINING WALL FOR COAL STORAGE.

The writer is watching with a great deal of interest the engineering operations pertaining to the rebuilding of the power house of the Indiana & Michigan Electric Company, at South Bend, Ind. The portion of the building which is to be reconstructed will be kept in use all the time, the steel and brick structure being built around and over the old building, which will be removed after the new roof has been completed, without stopping the motor-generator sets for a single hour. The accompanying illustration gives an excellent idea of the manner in which more room is being obtained in the rear of the station along a canal which supplies water for generating and manufacturing purposes. The body of the wall along the canal was constructed with sufficient width of base to enable it to retain the bank of the canal and also to carry some load, which, as the engraving shows, is made up of sundry motor parts and steam fittings, while in the distance may be seen a large pile of coal. The extension was built, however, for coal storage. The greater part of the output of this station is converted energy transmitted from a hydroelectric station at 25,000 volts. There



Overhanging Retaining Wall.

is, however, considerable steam-generating equipment in the station at South Bend for reserve use and for peak loads; hence the necessity for a large coal-storage space. The steel reinforcing of the concrete wall is ample, both horizontally and vertically, and in that portion of the retaining wall next the earth filling. By means of this arrangement the body of the wall was not necessarily as heavy as would be supposed, for when the extension over the canal is not loaded, the weight of the retaining wall is more than ample to sustain the overhanging concrete. When the overhang is loaded with coal, the main wall is also loaded with many tons weight and the additional weight thus placed upon the wall serves to aid in carrying the load on the overhang.

South Bend, Ind. James F. Hobart.

QUESTIONS AND ANSWERS

Can an induction-type watt-hour meter be used to measure the energy on a circuit having rectified current? L. T. R.

Not satisfactorily. Induction type watt-hour meters connected to circuits having certain types of rectifiers simply vibrate and do not register at all.

Are rotating standards used for testing large meters on direct-current circuits? K. O.

Rotating standards are seldom used for testing meters of over 200-amp rating due to the troubles from stray fields caused by the leads running into the standard. A water pail rheostat and voltmeter and ammeter are used instead.

In what city or town were series tungsten lamps first used? S. L.

From what we can learn the Hartford Electric Light Company, of Hartford, Conn., was the first to try out the series tungsten lamp. In May, 1907, this company installed 96 6¼-amp and about 350 5.5-amp lamps on its street lighting circuits.

I would like to know the weight and resistance of the No. 36 wire used in making the primary of the small transformer described in the May issue; also the weight and resistance of the secondary? E. W. Q.

The primary winding of the transformer mentioned consists of 1½ oz. of No. 36 double silk-covered magnet wire having a resistance of 400 ohms, while the secondary consists of 1½ oz. of No. 25 double cotton-covered wire having a resistance of 2.65 ohms.

Has water any damaging effect on babbitt metal in boxings? G. B. B.

We do not see how water can damage babbitt bearings unless it is substituted for oil, in which case, of course, lack of lubrication might cause damage. Genuine babbitt metal is composed of pure tin with a small quantity of antimony (about 2 per cent) added in order to make the molten metal to flow freely and to harden the bearing somewhat. Water would thus have no deleterious action on the metal itself.

Is it necessary to make any modifications or changes in a single-phase circuit when using the energy from it to ignite the charge of a gas engine through the usual spark coil? I. P.

Ordinarily single-phase current is not satisfactory for ignition purposes, due to the fact that the break in the circuit is apt to occur when the voltage is zero. To use alternating current for ignition purposes, it is necessary to synchronize the engine with the current in order to have the spark occur at the "peak" of the wave. In actual operation a high-speed gas engine ignited by an alternating current has an irregular spark supplied to it, which causes continual skipping.

Why are not fire-tube boilers used more frequently in central-station practice? H. E.

Fire-tube boilers are cheaper in first cost than water-tube boilers, and are efficient steam generators. They cannot be used in large sizes or on high pressures, 200 hp and 120 lb. pressure are about the respective limits for this class of boiler. Where high-pressure steam is required, as in modern central-station practice, water-tube boilers are generally best suited to meet all the conditions in respect to safety, operation and general adaptability.

Kindly explain why, when measuring power in a three-phase circuit with two wattmeters, one meter will read negatively when the angle of lag is greater than 60 deg. H. K. R.

On account of the method used in connecting two wattmeters for measuring power in a three-phase circuit, the voltage across one wattmeter shunt coil is 30 deg. ahead of the current in its series coil, while the voltage across the shunt coil of the other meter is 30 deg. behind the current in its shunt coil when the power factor is unity, that is, when the real circuit angle of lag of the current behind the e.m.f. is 0 deg. When the circuit angle of lag is 60 deg. the current in the series coil of one wattmeter lags by $(60-30)=30$ deg. behind the voltage across its shunt coil, while the current in the series coil of the other wattmeter will lag by $(60+30)=90$ deg. behind the voltage across its shunt coil. When the wattmeter angle of lag is 90 deg. its reading is zero.

Can induction regulators be connected inside and outside of the delta on the low-tension side of the transformer? E. F.

Induction regulators have been designed for both methods of connection. In either case the regulators have the same rating and weight for a given range of voltage regulation on synchronous converters of the same output. The only difference is in the winding of the secondary. When connected inside the delta, the secondary voltage is higher and the current lower than when connected outside the delta. In the latter case the secondary has fewer turns which are of greater cross section than those of the inside connected regulator. The complicated wiring necessary in the inside-the-delta connection owing to the limited space beneath the regulator has militated against the wide use of this type. The outside-the-delta regulator is the type most generally used.

Are there any objections to operating motion picture machines by means of electric motors? Such a scheme would be far preferable to manual operation; but no use seems to be made of motors for this purpose. A. I. B.

Objection has been made to the use of motors for operating motion picture machines because if the film should break the film in the top magazine would continue to come down in front of the lamp and, becoming wedged there, would take fire. If for any reason the motor should stop the intense heat from the lamp would also ignite the picture film. The latter is composed of pyroxylin, nitro-cellulose of low nitration, and is readily inflammable; combustion taking place after a few seconds if subjected to a temperature of 150 deg. C. or more. The pictures move through the lantern at the rate of 1060 per minute; but the photographic exposure is only 1.85 cm long and 2.5 cm wide.

Are direct and alternating currents sent commercially or otherwise over the same wires? If so, are they separated again for use on separate circuits? I mean, of course, in a manner somewhat similar to the quadruple telegraph, so that each current will do its separate work afterward. I understand that an alternating current can be impressed upon a direct-current circuit—as, for instance, in the telharmonium, where alternating-current music can be heard with a direct-current are lamp as a receiver. How would difference of voltage affect the result? W. C. P.

The simultaneous transmission over the same circuits of two currents of different frequencies or of a direct current and an alternating current has been tested under practical conditions and found to be operative. Neglecting the telegraph and telephone fields, however, the system is not in commercial use. Various engineering relations of numerous composite transmission systems were disclosed in publications by Dr. Frederick Bedell in 1903 and 1904.

Of what use are steam jets in boiler furnaces? Do they prevent the formation of smoke? N. A. W.

There are many forms of application of the steam jet to boilers. Sometimes the steam is applied below and sometimes above the grate. Below the grate the effect is perhaps slightly to increase the draft, but chiefly to soften the clinkers. Above the grate the steam jet is essentially for the purpose of inducing a draft of air over the fire and to mix the air with the gases from the coal. The steam itself is not a source of any heat. A number of smoke preventers employing steam jets are in successful use and when properly applied will reduce the tendency of boiler furnaces to smoke.

Central Station

Management, Policies and Commercial Methods

HELPING FIND TENANTS FOR HOUSES THAT ARE WIRED.

Houses that are wired for electric service rent more easily than the old-fashioned kind. A progressive Indiana central-station company impresses this fact upon property owners by maintaining an electrically lighted bulletin board on its outside wall at one of the most prominent corners of the little city, on which it enters the address and a brief description of all houses equipped for electric service which are for rent. The property owners, too, have come to realize the value of this kind of advertising, for the houses offered on the board are usually snapped up quickly. On the one extreme this fact has resulted in having old houses wired about as rapidly as they become vacant. Then they are not vacant much longer.

CENTRAL-STATION ELECTROMETALLURGICAL LOAD.

The manager of the Sheffield, England, municipal electrical plant has asked for a grant of $400,000 to extend the capacity of the newest of its several generating stations. This station —that at Neepsend—was opened in 1904 with a capacity of 3000 kw; in 1908 this was increased to 7000 kw, and the station is now overloaded. In an interview the manager stated that the great increase is not so much due to lighting load as to demand for power and heating. A large demand has developed in the form of heating for electric smelting furnaces in the East End Works, and indications point to very considerable extensions in this direction. Already two furnaces have been connected to the supply mains, and others are awaiting connection.

ONLY ELECTRIC SIGNS MAY EXCEED THREE-FOOT LIMIT AT FORT WAYNE, IND.

The enforcement of the building ordinance recently adopted in Fort Wayne, Ind., which allows electric signs to project 10 ft. over the sidewalk while non-illuminated signs are permitted to extend only 3 ft. from buildings, is resulting in the installation of a number of more or less pretentious electric displays to take advantage of the freedom given the favored class. Little attention had been paid to the existing ordinance until recently, when the city authorities decided to repair their omission and demand the removal of all offending signs on certain streets. The result has been a marked boom in the electric sign business. When the ordinance was originally passed, its sponsors took the viewpoint that electric signs add to the illumination of the street and thus aid the city lighting, so they should be favored and their installation encouraged.

VACATION-TIME IRON CAMPAIGNS.

The conjunction of hot weather and school vacations makes a time which is especially favorable for the central-station man endeavoring to stock up his lines with electric irons or other heating appliances. One electric company in a small Indiana city, which has been especially successful in putting out this class of domestic apparatus, reports that its best results in placing irons are secured with the co-operation of the school children. An advertisement among the small "want" notices in the local paper brings 50 to 100 boys and girls to the office. Each of these is given an iron to sell or place, being offered a commission of 50 cents for each iron sold in this manner.

The young folks frequently gain an audience, especially among their neighbors, which a regular solicitor would be unable to obtain, and as an indulgence, often get some older objecting friend to try an electric iron, to her delight and ultimate purchase. It is the experience of the company cited that electric irons put out in this way invariably "stick" to the satisfaction of both customer and company. As the transaction with the youthful agent is, of course, entirely on a commission basis, the actual charge for selling the iron is small, compared with that of keeping a regular solicitor on the road, with indifferent success. The company keeps a record of the destination of each iron.

ORNAMENTAL POST LIGHTING AT GRINNELL, IOWA.

The Grinnell Electric & Heating Company has entered into a contract with the Grinnell Commercial Club for a system of lighting the business district with lamps on iron posts supplied from conduits run under the sidewalk along the curb line. There will be 128 posts in all, spaced 100 ft., for which $129 per month, or $4.60 per post per month, will be paid. Each post will have two 60-watt lamps and one 100-watt tungsten lamp. The 100-watt lamp, which is on the top of the post, will be burned all night every night, while the two 60-watt lamps will burn until 11 p. m. every night except Saturday, when they are to burn until 12 p. m. At the end of seven years the Commercial Club will become the owner of the entire system, including conduits, posts and electrical equipment for which the only costs will be for electricity or operation. Grinnell has a population of about 5000.

WHAT AN ELECTRIC WASHING MACHINE SAVED ONE BARBER SHOP.

Up to nine months ago the Randall five-chair barber shop of Fort Wayne, Ind., was paying ½ cent apiece for having 1200 to 1500 towels laundered each week. The laundry bill accordingly averaged $27 per month; added to which was a charge of about $3 per month for replacing, at 5½ cents each, the towels which were lost and torn in the laundry operation. A chance remark by the barber on the subject of this $30 monthly tax, to Mr. J. B. Weidgenant, contract agent of the light and power department of the local electric company, as he was being shaved one day, led the central-station man to suggest that something might be done to alleviate the situation by having a motor-driven washing machine installed.

The washing machine was accordingly installed on a 30-day trial proposition, and did its work so excellently and economically that it was immediately purchased at the end of the trial period. After several months' subsequent experience, the manager of the barber shop reports the following success: The entire shop laundry, including that of the barber's family, is now done by the shop porter in two hours' work three days a week, at a total expense of $5 a month for electricity and gas. As first installed, gas-heating elements were employed, although electric heat will probably be substituted later. The electric bill probably represents $2.75, of which the largest item is undoubtedly for lighting the barber's house, as no separate meters have been installed. The porter works two hours every second morning washing, and another hour for ironing the pieces. He is thus engaged about nine hours a week in laundering 1200 or more pieces, practically all of the physical work being performed by the machine. The electric washer does not rip or tear, and no towels are lost, so that the renewal item of $3 monthly is at once abolished. As the porter's time is otherwise lost, no labor charge is attributable to the washer.

The washing and ironing outfit complete cost $135. Figuring a monthly saving of $25, or even $20, this barber shop is

deriving a return of $240, or almost 200 per cent, on its electric washing machine investment. The barber is enthusiastic over his results, and this fortunate installation has been the direct means of selling a dozen other washers besides affording many of the shop's customers eloquent and first-hand testimony of the satisfaction of electric devices.

TO REMIND THE NEW TENANT.

As a reminder to the new occupant of a house or dwelling wired for electricity, in which the meter has been taken out at the removal of the last tenant, the Marion (Ind.) Light & Heating Company is experimenting with a post-card scheme for revealing to the succeeding occupant how easy is the matter of re-establishing electric service.

When a house is vacated, and the company's man goes to take out the meter, he leaves tied to the hallway chandeliers, usually, a printed return postcard, carrying the following suggestion:

"NOTICE.

"The last occupant of this house used electricity with entire satisfaction.

"Fill in blank space with your name and address, mail to us, and our representative will call promptly and arrange to install meter for you.

"Name .....

"Address ....."

The reverse side of the card is already stamped and addressed to the electric company, involving a strong invitation to the new householder to learn something about the company's viewpoint and rates. This plan has been tried only for several weeks in Marion, but in spite of the obvious lag in its operation a number of cards and inquiries traceable directly to these timely suggestions have already been received at the office. Mr. H. E. Gant, of the new-business department of the company, is very much interested in the experiment with these cards, and predicts that the results of the scheme will prove it well worth the meter man's additional trouble taken to affix the card.

"ELECTRICAL WONDERS" AT WHITE CITY.

A show attraction for the advertising of central-station service has been created recently by the Comonwealth Edison Company of Chicago, at the White City Amusement Park, by means of an exhibit of household electrical applianees and two sets of moving pictures, one showing the use of electrical conveniences in the home, and the other illustrating the operation of the Fisk Street and Quarry Street power houses. This display gives an instructive and entertaining half-hour to many of the thousands of amusement seekers who nightly throng this park.

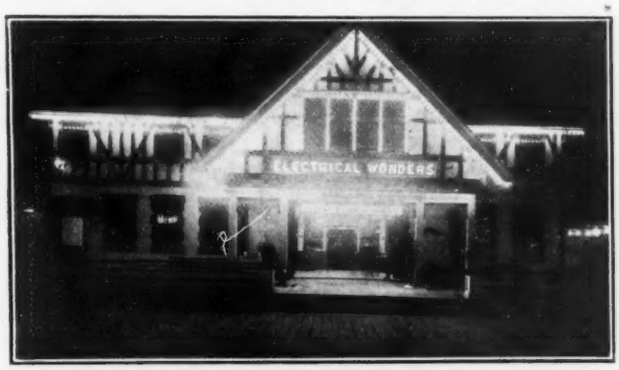


Exhibit Pavilion of Commonwealth Edison Company at White City, Chicago.

The company has leased for the entire season one of the large concession buildings, which it has fitted up as an auditorium and exhibit room for electrical cooking and heating appliances. Outside of the building, a clothesline full of washing and a motor-driven washing machine, with an attendant, comprise the "ballyhoo" act which attracts the casual visitor into the exhibit room. Attendants are on hand to explain the uses of the various electric heating and cooking devices shown, and once hourly an exhibit of the moving-picture films is given. The first of these illustrates the many uses of electrical conveniences for the home, and is one of the films formerly exhibited at the 1910 Chicago Electrical Show and already described in these columns.

Following several comedy pictures and a number of really handsome slides showing the interior of the beautiful Electric Shop of the Commonwealth Edison Company at Jackson and Michigan Boulevards, a new film, made only a month ago, takes the audience for a promenade through the great power houses of the Chicago central-station company, the Fisk Street and the Quarry Street stations. These views include a panorama of the Chicago River, showing both stations, and detailed views of the coal handling apparatus and hoisting conveyors, the automatic furnaces and the turbo-generator rooms of each station. The closing feature of the power-house pictures, which lends itself especially to the purpose of an interesting film, is a run by the plant fire department in response to an alarm. The men, drawing hose-reels, are shown dashing down the river bank, and within less than one minute from the time the first company appears, a dozen streams are in operation playing on the imaginary fire.

This moving-picture exhibit of the Commonwealth Edison Company will be operated every night, seven days a week, during the present White City season. The auditorium seats 200 people, and the staff comprises two demonstrators, two doormen and one moving-picture machine operator. Mr. Charles F. Stark, of the advertising department of the Commonwealth Edison Company, is in immediate charge of the White City exhibit.

DECISIONS ON INJURY FROM NEGLIGENCE.

The Kentucky Court of Appeals has decided that damages cannot be awarded for electric shock as a result of a lineman's failure to use appliances furnished. Two employees of a telephone company were commissioned to remove a telephone from the home of a subscriber. They took out the instrument and disconnected the wire from the house at the point where it entered the dining room, but had not taken it off the front corner of the house. One of the men then picked up the wire where it had dropped down after it was disconnected from the house at the dining room, and began to wind it up in a coil, in doing which he gave the wire a pull to get it off the front corner of the house. The other man had cut it off at the pole in the street; and either from its being cut off, or the pull given, it so came in contact with a trolley wire, the latter received a shock and was so burned that he narrowly escaped death. The wire was not insulated, and it was a custom to insulate the wires which passed above the trolley of the railway company. The man knew the wire was not insulated at the point where he picked it up, but he did not know what its condition was between the house and the pole. He brought suit to recover for his injuries against the telephone company, in which proof showed that wires like this, when adjacent to high-voltage wires like trolley wires, should be removed either by the men using insulated pinchers or by making a coil in the wire, tying a rope in this and pulling the wire down with the rope. It was also shown that the men had with them a rope for this purpose. If this method of getting the wire down had been followed, there would have been no danger in handling it.

It was held that the company was not liable. The rule that the master must use ordinary care to furnish the servant a reasonable safe place to work is subject to the exception that the servant takes the risks resulting from changes made by the servant himself in the ordinary progress of the work. Servants who pull down or dismantle houses or other structures acting under a general direction to do the thing, but taking their own course in doing it, assume risks not assumed by

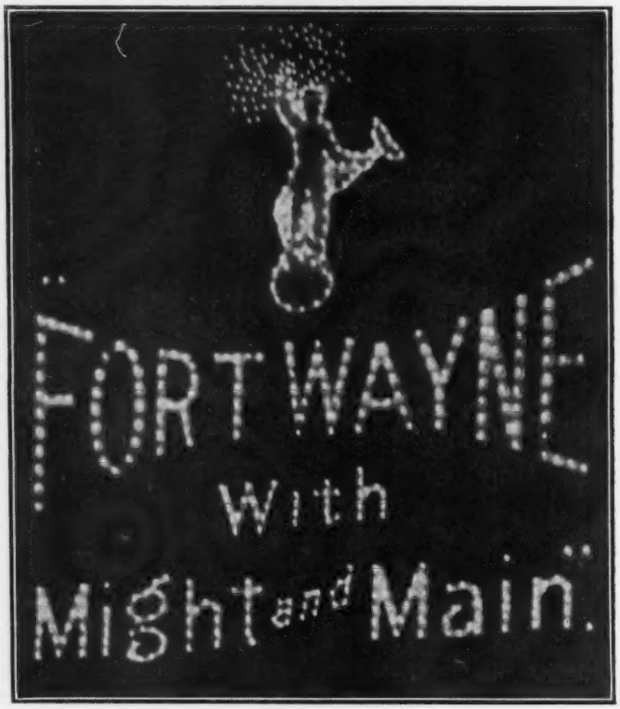
servants in putting up new work under the direction of the master. The reason is obvious. The material is old, and the servant may reasonably anticipate it is not in good condition. He must keep his eyes open, and use ordinary care. The insulation on a wire is subject to atmospheric action, and like other things, in time decays; and though this wire when put up had been insulated, the plaintiff had no right to assume that it was still in such condition that it could be safely dragged across the trolley. He had been furnished a rope with which to take the wire down, and, if he had used it instead of taking the wire in his bare hands, there would have been no danger. The injury was due, not to any fault of the master, but to his own way of doing the work.

In another case the same court held that an electric light company is not liable for death of electrician caused by negligent operation of a switchboard. An electrician, in sole charge of the defendant's light and power plant, had been working in that capacity for about six weeks, and had previously had several years experience in other, but smaller, plants. One of his duties was to turn off the street arc lamps, which was done by pulling two plugs out of the switchboard. These plugs were about 10 in. in length, and ran into sockets in the switchboard, and each of them had a rubber handle about 5 in. long and perfectly insulated. The evidence very clearly established that the proper way in which to turn the lamps off was to pull out one of these plugs at a time, and that if this method was observed there was no danger. The evidence also established that even if both of them were pulled out at the same time, as they might be by taking hold of the insulated handle of each, there would be no danger, unless some part of the hand came in contact with the plugs before they were entirely pulled out, and beyond the point at which they were insulated. It is also clearly shown that the electrician knew that the proper method of cutting off the lamps was to pull one of these plugs out at a time, and that he also knew that it was dangerous to attempt to pull both of them out at the same time; and, being the electrician in charge, he knew that if his hand or fingers touched the uninsulated part of these plugs before they were pulled out that death might result. There was no serious contradiction in the evidence that the method of pulling these plugs out was very simple and entirely safe if the slightest care were exercised by the operator to prevent his fingers or hands coming in contact with the uninsulated part of the plug, which it was not necessary in any state of case to touch in order to pull the plugs out. The electrician, in attempting to shut off the lamps, pulled both plugs out at the same time, and in some manner permitted one finger on each hand to come in contact with the uninsulated plugs. The result was instant death. It was held that the negligence of the electrician barred a recovery of damages against the company. In cases like this all that the master is required to do is to furnish reasonably safe places and appliances, and that this degree of care does not demand that he should furnish the very latest and best improvements. It will be sufficient if those furnished are in general use.

ELECTRIC COMPANY ADVERTISES A CITY'S MOTTO AT OWN EXPENSE.

Some months ago the city of Fort Wayne, Ind., adopted as its municipal slogan the words "Fort Wayne with Might and Main." Shortly afterward, with the idea of presenting this motto in brightly illuminated letters to the chance stranger, as well as impressing its significance on the citizens themselves (without, of course, losing an opportunity to popularize and demonstrate the use of electric signs), the lighting department of the Fort Wayne & Wabash Valley Traction Company, which supplies the local commercial lighting, erected the large ornamental motto sign illustrated herewith, at one of the most prominent corners in the city. This sign measures 20 ft. x 30 ft., is mounted on the roof of a four-story building, and contains about 500 4-cp carbon lamps. The upper figure of the design is to represent in idealized form the spirit of the city.

The sign was erected and has been operated for several months, entirely at the expense of the electric company, which has looked to no one for the cost of the sign or its energy supply. However, the public's appreciation of this evidence of the company's spirit and co-operation has made the sign



Fort Wayne Electric Sign.

and the energy taken to light it a good investment. Strangers inquire about this unusual manifestation of a city's spirit, and the handsome appearance of the sign has aided in the introduction of other illuminated displays of which Fort Wayne is just beginning to get its share. The city has recently discussed the matter of purchasing this sign for installation in a position facing the tracks of the principal railroads passing through Fort Wayne.

TUNGSTEN LAMP PRACTICE IN NEBRASKA.

Mr. Joel Roberts, of York, Neb., wrote a report for presentation at the convention of the Nebraska Electrical Association, May 3, in which he gave answers compiled from a number of Nebraska central stations on their practice as to handling tungsten lamps.

In answer to the first question, "Do you furnish free installations of tungsten lamps?" all answered "No." Six companies reported that the use of these lamps has not caused a noticeable increase in load; one noted an increase of from 10 per cent to 15 per cent; one noted a temporary falling off of load; six reported an increase in earnings; two no noticeable effect, and one a reduction. As to sizes of lamps used, two companies are introducing lamps ranging from 40-watt to 250-watt sizes; three make a practice of installing 100-watt single units as far as possible; one installs five-lamp chandeliers with prismatic glass reflectors; five have some series tungsten lamps on the streets and four have not. For street work seven companies prefer suspension of the lamp from a span wire; one prefers supporting from a bracket, and one prefers brackets unless the lamps are of the series type.

As to his experience at York, Mr. Roberts said that the load was not growing as fast as formerly, but the number of consumers has increased very much. The tungsten lamp has proved

a formidable rival of gasoline lighting systems. In stores it is the practice to use 60-watt or 100-watt sizes in single units scattered over the area to be lighted.

Mr. H. A. Holdrege, of the Omaha Electric Light & Power Company, said that the tungsten lamp had caused a great increase in the number of customers, especially among those formerly using other illuminants. Mr. Frank McMaster, of Beatrice, said that tungsten lamps had brought his company a lot of small consumers, many of whom were of the "kicker" class. Some consumers who were not profitable from the company's standpoint had been changed to better consumers, because of the greater number of hours' use of the installation each month.

Mr. J. R. Cravath expressed gratification at the reports furnished to Mr. Roberts because none of the companies advocated the use of the cheap open clusters with flat porcelain shades, which have been introduced extensively in some places where there is little regard to obtaining the best illuminating results. The questions indicated good illuminating engineering practice among the stations answering.

Mr. McMaster inquired what could be done to induce customers to accept the more modern types of chandeliers for tungsten lamps in which the lamps are placed close to the ceiling. He said his customers insisted on having old-style, long chandeliers with the lamps low. Mr. Cravath said that this is somewhat a matter of psychology and salesmanship. No man likes to think that he is purchasing something which is not modern or which is likely to go out of fashion soon. If it is explained to the customer that the old-style long chandeliers are going out of use and are now out of date, it will have fully as much weight with him as the more important reason for using short chandeliers, namely, that of getting better and more comfortable illuminating results.

Mr. W. J. Scoutt, of Kearney, told of a business man from his town who had a $13 monthly bill for his residence and complained bitterly. Mr. Scoutt put 556 cp in tungsten lamps to replace 348 cp in carbon lamps. The bill was reduced over one-half. The consumer then called him a fool and asked him why he had done it. The answer was to make a satisfied consumer. He had not been using the 250-watt lamps until recently. He had used the 100-watt lamp extensively for displacing gasoline plants. Twenty-five lamps of the 250-watt size had recently been installed with great success.

Mr. McMaster told of a case where one of the first stores in Beatrice to install tungsten lamps had recently complained of insufficient light. He had told them at the time of installation that they were not putting in enough, as they were providing only 0.416 watt per square foot. After this installation was put in another store in town had asked him to plan as good a lighting installation as possible, leaving the matter to him. He had made this latter installation with 1.25 watts per square foot.

Mr. Seabury, of the General Electric Company, said that not over 25 per cent of the carbon-filament lamps are now being sold which were sold two years ago, this, of course, being the result of the tungsten lamp introduction. The tantalum lamp is now in better shape than two years ago and has a good life, even on alternating-current circuits. As a moderate-priced lamp which will stand hard usage it has a field.

President B. C. Adams, of Lincoln, pointed out that there is a field for the tantalum lamp where energy is being obtained at very low rates. Mr. Bell, of David City, said that his company had pushed tungsten lamps probably as hard as any in the State. The load had increased from 7 to 10 per cent.

Mr. Norton, of the Lincoln, Omaha & Beatrice Railway, which operates electric lighting service in Bethany, reported that the tungsten lamp had stimulated residence business. This company gets a deposit of $12 from the consumer for each meter installed. This takes care of the meter investment. It is explained to the consumer that this deposit is necessary on account of the low rate which is being given. Mr. Bell, of David City, told of the use of a small transformer made by the Butler Electric Company, of David City, which is being used by some consumers to reduce the voltage from 110 to 19, so the low-voltage tungsten lamps can be used. Mr. Seabury said that it is unnecessary at the present time to change over to low-voltage lamps in order to get good life for residence use. Low-voltage transformers are being used for sign lamps. In Wichita, Kan., signs of 6000 lamps aggregate capacity are being operated on a flat rate from low-voltage transformers.

The question of handling consumers requiring only one or two lamps was brought up for discussion at this point. Mr. Bell, of David City, said that it is his custom to charge each consumer 75 cents per month per 50-watt lamp. Some others reported putting all consumers on flat rates, no matter how small. Mr. D. L. Bender, of Fairmount, reported getting a $5 meter deposit from each customer.

Wiring and Illumination

ELECTRIC LIGHTING OF A SAILING YACHT.

The trim schooner-rigged sailing yacht *Nomad*, a 50-footer of the Chicago pleasure fleet, has the distinction of being equipped with electric light throughout, including an electric search-lantern, the entire equipment being supplied with energy from storage cells carried aboard. The cabin has accommodations for seven persons and is lighted by three 6-cp, 6-volt tungsten lamps mounted on the ceiling behind bull's-eye reflectors, which aid in the effective and economical distribution of the light. In each of the two staterooms is a 4-cp, 6-volt tungsten lamp, while the sixth unit of the interior illuminating system is a 1-cp, low-voltage tungsten used as the binnacle lamp to light the compass card. The lighting equipment is supplied with energy from a three-cell storage battery, capable of furnishing 135 amp-hours at 6 volts. A 6-volt storage battery of the portable type used for ignition purposes is also employed to light a deck-lamp which is enclosed in a strong parabolic reflector. This lamp is used as a head lantern and also as a torch for signaling, when necessary. The storage batteries are charged on shore between trips; as the vessel is ordinarily used, one battery charge frequently supplies energy for the lamps for a month.

SPECIAL MULTIPLE-TUNGSTEN STREET LIGHTING FOR FORT WAYNE, IND.

The 10 principal business blocks of Calhoun Street, Fort Wayne, Ind., are to be lighted by tungsten groups carried on ornamental iron pillars, eight to the block. The standards will have cast-iron bases with wrought-iron tapered poles, which carry the ornamental brackets at a height of 14 ft. above the sidewalk. Each pillar will carry four 60-watt multiple tungsten lamps on its side brackets, and a 100-watt tungsten in the top fixture at the center of the pole. All lamps will be enclosed in opal globes.

The expense of furnishing and installing the pillars will be borne by the adjacent property owners, the City Council having approved an ordinance which requires each owner along the streets on which the special lighting will be installed to pay an assessment proportional to his front foot space. The general city government will pay for laying the conduit and making connections to the pillars, and afterwards will furnish the energy for lighting the lamps from the Fort Wayne municipal generating plant. The 60-watt lamps on the side arms are to burn from dusk to 11 o'clock, and the 100-watt lamps on the peaks of the posts all night.

After the first installation has been started it is planned to extend the special illumination by the addition of 200 more pedestals, around the court house and on Columbia and Bary Streets. The estimated cost per standard is $40. Much of the conduit for the first installation is now laid, and the contract for the posts will be let shortly.

BATTERY LAMPS FOR EMERGENCY USE ON SHIPBOARD.

A night-lamp circuit, containing 25 4-cp, 110-volt carbon lamps, supplied with energy from a storage battery, has been installed on the steamship *Alabama* of the Goodrich Line, plying on Lake Michigan between Chicago and Muskegon, Mich. The battery is mounted at the highest point of one of the upper decks, so that in case of emergency or accident, as in the event of the vessel's foundering, the corridors will continue to be illuminated to aid in the escape of passengers, even after the engine-room becomes submerged and useless. The battery of 56 cells has a rated output of 4.5 amp for eight hours, and will supply energy to the 25 lamps above noted for 10 hours at a charge. At night, after the regular generator circuit has been turned off, the deck and corridor lamps always receive energy from the battery exclusively, so that in case of any accident, sufficient light is assured, without the manipulation of switches or automatic devices, to assist in passengers' escape. The battery is charged during the day from the ship's generators.

AMENDMENTS TO MUNICIPAL WIRING RULES IN CHICAGO.

In Chicago the rules and regulations of the Department of Electricity of the city government relating to the installation of electrical wires and apparatus are incorporated in a city ordinance and have the force and effect of law. This plan has obvious advantages in enforcing the rules, but it also has some disadvantages, because, with the rapid development of the art it becomes necessary at rather frequent intervals to modify the rules, and to do this, it is necessary to introduce a new ordinance in the City Council, have it referred to the proper committee, and in due time reported on, published and passed. This procedure, which takes considerable time, was followed in the case of some amendments to the rules covered by the ordinance to that effect reported by the committee on gas, oil and electric light, and passed by the City Council at its meeting of June 6 last.

By the new ordinance the rules and regulations contained in the familiar little blue-covered book, edition of 1909, are modified in a few particulars. The amendatory ordinance contains ten sections, and omitting the enacting clause constituting Section 1 and the final section, which says that the ordinance shall be in full force after its passage, approval and due publication, the remaining eight sections may be summarized as follows, the paragraph numbers relating to the printed code containing the "Rules and Regulations" of the Department of Electricity of the City of Chicago:

Section 2 covers an amendment to Paragraph 5, by striking out clauses (a) and (b), which required the use of lightning arresters on all outside lines over 100 ft. long. It has been found in practice in Chicago that where lightning arresters are not maintained under expert supervision they are liable to do more harm than good, and it has been thought best to waive the requirement.

Section 3 amends clause (f) of Paragraph 12, by which the requirement for soldering joints on all overhead pole-lines construction is repealed.

Section 4 amends clause (c) of Paragraph 14 in such a manner as to allow the use of patent splicing devices where they make a joint as good as the regular soldered joint. This paragraph comes under the rules relating to inside work.

Section 5 amends clause (c) of Paragraph 19, so as to repeal the requirement of a wire mesh around arc lamp globes. This is now considered an obsolete requirement.

Section 6 amends Paragraph 64, which has to do with the wiring for signaling systems, telephones, telegraphs, district messenger circuits, fire and burglar alarms, etc. Here in clause (a) the requirement of a brick partition in manholes separating signaling wires from electric service wires is repealed; provided, however, that the low-potential and high-potential wires are properly installed on opposite sides of the manhole.

Section 7, amending clauses (c) and (d) of Paragraph 65-A, has changed the requirements for moving-picture machines, making these requirements a little more strict than heretofore. This amendment also allows the use of a steel receiving tank on moving-picture machines, but requires that this tank be so arranged that it shall be practically impossible for a lighted film or a spark to enter the tank. In the past the ordinance allowed only the use of the take-up reel.

Section 8 amends clause (c) of Paragraph 68 to require the use of larger bolts for the support of electric signs. This amendment also requires the use of two turnbuckles on such signs as are required to have two supporting chains. It has been found that the chains or cables stretch, and where only one turnbuckle is used the whole weight of the sign is put on the one cable in making it straight.

Section 9 also amends Paragraph 68, relating to electric signs, but the present amendment does not in any way alter the previous requirements. Various clauses of the paragraph have been rewritten to shorten and simplify it.

CENTRAL-STATION ELECTRIC SIGN ON NEW YORK BAY.

Approaching New York from the sea one sails through two magnificent bodies of water, Lower and Upper New York Bay. These are joined by The Narrows, a strait between Brooklyn and Staten Island. Skirting the bluff on the Brooklyn shore is one of the finest driveways in the world, known as the Shore Road, extending from Fort Hamilton on the south to Owl's Head on the north, where it turns in and becomes a part of the boulevard system of the city. Owl's Head has a commanding position, overlooking both bays, and here it is that the Bay Ridge station of the Edison Electric Illuminating

Fig. 1—Day and Night Views of Brooklyn Edison Sign at Bay Ridge Station.

Company of Brooklyn is located. The company has just completed an electric sign 200 ft. long on the dock in front of the station; the large letters on the sign being 18 ft. high and the other letters 12 ft. high, the framework being 33 ft. tall. Exactly 1962 5-watt, 10-volt tungsten lamps are used to illuminate the sign, which is the biggest in Brooklyn and is visible all along the bay and its shores from The Narrows to the Battery. Alternating current is used and the potential is first stepped-down to 120 volts from 2300 volts by two transformers and then to 10 volts in 16 transformers, one on the back of each letter.

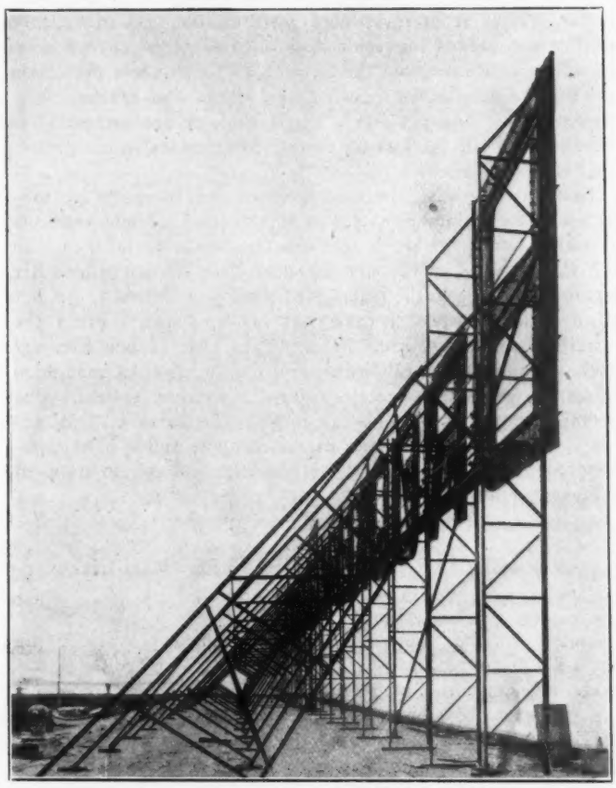


Fig. 2—Side View of Edison Sign at Owl's Head.

There is a double row of lamps near the edges of each letter and the latter is made with a 3-in. wall projecting forward from its face. This wall confines the light, giving to each letter a clean-cut appearance. In order to withstand the tremendous wind pressure sometimes exerted on the Lower Bay a specially constructed angle-iron framework is used, the design of which is clearly shown in Fig. 2. The sign can be read easily from the Staten Island and Jersey shores.

MANHOLE PROTECTION FOR HIGH-TENSION UNDERGROUND CABLE SYSTEMS.

By S. D. Levings.

Of the operations involved in installing and making ready for service high-tension underground cable systems, that of affording protection to the portion of the system which passes through manholes is one of the most difficult. In the earlier installations of such systems, when 2200 volts was considered the allowable maximum for underground cable transmission, manhole protection was not considered a necessity; but as the number of cables increased, making it necessary to rack two or more of them on the same support and hence in very close proximity to each other, and as voltages were gradually being raised, manhole protection became not only an apparent necessity, but an imperative one. As the voltage of these systems was gradually increased to such tensions as 9000, which is standard with the Commonwealth Edison Company of Chicago, "blow-outs" became more frequent. If this form of trouble, which is feared by lighting companies possibly more than any other, would confine itself to the destruction of the cable which originates it, conditions would not be so bad; but quite to the contrary, it is safe to say that no unprotected cable within the confines of the ordinary manhole is safe when the high tension "lets loose."

As to the cables themselves, there is no good reason why it should be assumed that the portions which pass through the manholes are not possessed of the same integrity as those in the ducts of the conduit system, unless some may consider the splice the weakest point in the cable. As a matter in fact, it is generally conceded that a splice, properly constructed, is as perfect electrically and mechanically as the continuous portions of the cable. Therefore, there is no reason why "blow-outs" should occur in manholes more frequently than in the ducts, and this deduction is borne out in practice.

On the other hand, as such accidents are liable to occur in manholes, and as the cable, unprotected, is in danger of mechanical damage, to which the portions in the ducts are not subjected to the same degree, it seems a logical conclusion that manhole sections should be provided with the same protection as that afforded by the ducts. The prime object of this form of protection is the safeguarding of each cable against the results of internally caused accidents to other cables in the manhole, and from external mechanical injury.

Lead fuses at about 330 deg. Fahr. There is no record of the temperature of the arc caused by a high-tension "blow-out" nor of the surrounding atmosphere, but it is known that such discharges are measured in many hundreds of degrees, and that a large heat field is instituted. In any event, practice has shown that in some instances the sheaths of cables several feet away from a "blow-out" have been melted away from the cores, while the cables adjacent to the "erupting one" have not only suffered the removal of the sheath, but the complete disintegration of the insulation and sometimes the copper conductors themselves. It can readily be seen then, that unprotected cables are subject to injury from accidents to others, and when all are unprotected, the trouble generally becomes a cumulative one until finally all of the cables of the system in a particular location are put out of service at the same time.

When a "blow-out" occurs in the ducts, the heat generated is not of sufficient duration, despite its intensity, to penetrate adjacent ducts and cause injury to cables therein contained. The insulation resistance of the combined thicknesses of duct walls is generally sufficient to withstand the strain of the breakdown, or else the discharging current does not have an opportunity to concentrate and puncture the walls separating adjacent cables. If the same protection is given the cables in passing through the manholes as is afforded by the ducts, it is safe to assume—and the fact is assured by practice—that an accident to any one of the cables will be confined to that cable.

There are two commonly used methods for providing this protection. One adopts asbestos in the form of pipe covering for the protecting medium, the materials being secured around the cable by means of brass or copper bands. Moisture is excluded by giving the finished covering a coat of moisture-proof compound. The asbestos covering may be purchased split, so that it may be slipped around the cable, and bends are made with standard asbestos bends, the cable being made to fit the best combination of coverings between the ducts through which it enters and leaves. This protection has the marked advantage of being easily worked and handled, but it possesses the pronounced disadvantage of offering a poor mechanical protection. The other method employs split vitrified tile ducts, similar in construction to the main ducts of the conduit system.

This latter method is in use by the Commonwealth-Edison Company of Chicago, and the interior views presented in Figs. 1 and 2 are of interiors of manholes containing cables so protected. Like the asbestos covering, these split tile ducts are manufactured with standard radii of curvature, and may be obtained in several diameters and thicknesses of wall. It is, of course, obvious that a duct of sufficient diameter to clear

the sleeve of the splice must be used. In planning protection with tile ducts, the duct line through the manhole with its support is first laid out. The method of supporting the ducts depends upon the characteristics of the manhole, and where the duct lines enter close to the floor and right angle turns in the cable are necessary, the method shown in Fig. 1 is employed. A channel or angle iron, the latter being the cheaper, may be employed as the main supporting medium, the ducts be-

Fig. 1—Method of Supporting Ducts in Manhole.

ing laid on a plank to fit the iron, thus obtaining a broad surface of support. The angle, or channel, as the case may be, can be either let into the manhole wall, or can be supported on brick or concrete piers at its extremities. It is always advisable to provide piers under the duct line where it emerges and enters the main duct system. Such a pier is plainly shown in Fig. 1.

As previously stated, the tiles are split, and it is necessary to apply cement mortar freely. Owing to this fact the work generally possesses an untidy and unworkmanlike appearance. No protection from cement is necessary when covering the horizontal joints, unless the two portions of the tile are not in line, or unless the edges are badly broken. Where vertical joints cannot be well closed, owing to bends, a strip of muslin or burlap may be placed around the ducts to guard against the entrance of mortar. The application of cement is the saving operation in this work, as many times the duct lines are required to be self-supporting for short distances, as indicated in Fig. 2. While the ducts to a greater or less extent rest upon

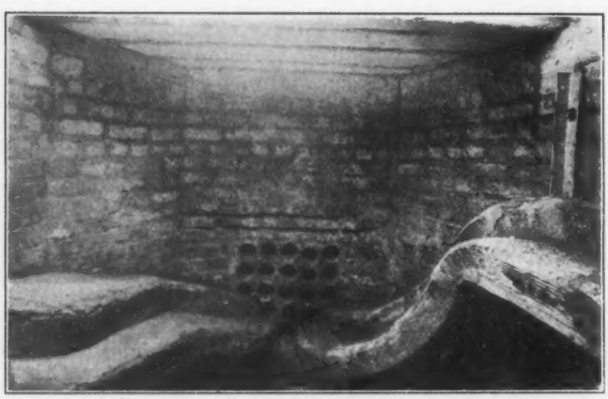


Fig. 2—Self-Supporting Ducts in Manhole.

the cable, such pressure is to be avoided when possible by properly aligning and bonding.

Where the cables pass from one end of the vault through to the other, the duct lines may be supported on channels or angles laid across the arms of the cable supports, as illustrated in Fig. 2. The plank is provided as previously described. As it is not desired to raise the ducts in the vault any higher than necessary, as many ducts should be placed on the lower arms of the supports as possible. It is often advisable to plan for high-tension cables many years in advance of their installation. For this reason, and also because it is common practice in all underground systems, the lower ducts should be reserved for high-tension cables.

The segregation of conduit systems into high and low-tension portions, each independent of the other, is advocated by many engineers, and the chief cause for such opinion is the fear for the low-tension system, should a "blow-out" occur in one of the high-tension cables. By adopting the manhole protection, as outlined, no fear of this nature need be entertained, and a large portion of the two-system conduit investment may be eliminated. Aside from investment features, the loss of revenue during time needed for repairs to broken down cables represents a considerable item, and the advantages of manhole protection can best be determined by calculating the loss of revenue occasioned by a "blow-out" on a single cable where protection is installed, against the loss on two or more cables where protection is not afforded.

Last but not least, the employees of the company are protected to the maximum extent by this method. While accidents resulting fatally are more frequent among the aerial men than the underground workers, cases have been known where life has been lost due to the inability of some poor fellow to get out of a manhole when a cable has broken down. From the standpoint of investment, the pecuniary cost of one life, say nothing about the moral responsibility, is more than enough to offset the protection necessary for the average system. The actual cost of this work is not large. The amount varies according to the characteristics of the manhole and it is not possible to give a unit of cost or one near enough to base an estimate upon.

A PECULIAR UNDERWRITERS' RULING.

By G. S. Kemery.

In the *National Electrical Code* for 1909 approval for the use of Edison plug cut-outs is given only for voltages not exceeding 125 for 0 amp to 30 amp cut-outs and not at all for 31 amp to 60 amp cut-outs. A ruling to this effect could not be found by the writer in the handbook of "Installation Rules," but in the handbook of "Construction Rules," which indicates how the apparatus is to be constructed, are clauses which, although expressed in a different way, have essentially the above meaning. In effect manufacturers are directed to

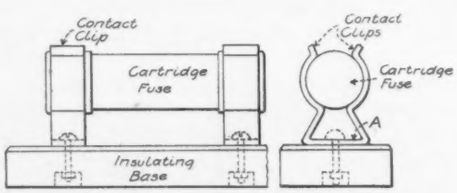


Fig. 1—National Code Cut-out and Fuse.

cease making Edison plug cut-outs for 31-60 amp fuses and not to equip apparatus operating at voltages in excess of 125 with those of 0-30 amp capacity. There is nothing to prevent the manufacturer from making this contraband equipment; but work in which it is used will not be approved. Under such conditions it is likely that the demand for it will shortly end.

It is not the manufacturer that will suffer, however, as he can furnish other appliances that from his and the Underwriters' viewpoint will supersede the Edison plug cut-outs satisfactorily. It is the user that suffers, the industrial plant maintenance man and the men higher up that own the plant.

If the writer's understanding of the ruling is correct the type of cut-out, fitted with a National Electrical Standard fuse (see Fig. 2), indicated in Fig. 1, must be used for 0-30 amp if the voltage exceeds 125 and does not exceed 250, and it must be used for all voltages below 250 for 31-60 amp. This type of cut-out has three inherent disadvantages, which are: (1)

It is frequently difficult to remove the fuses from the cut-out without introducing a tool of some sort. (2) The contact clips get bent intentionally and unintentionally and this results in loose connections. Sometimes the contact fingers are broken off entirely. (3) It is difficult to remove or replace fuses, particularly in the 0-30-amp size, without danger of shock.

Probably none of the above detriments is of much consequence where cut-outs are used in residence and office-building illuminating installations, where fuses are very seldom blown.

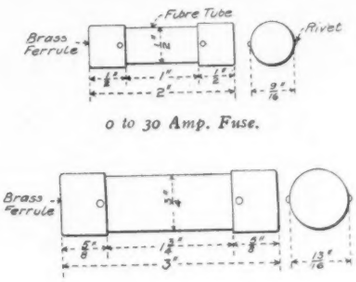


Fig. 2—National Electrical Code Standard Fuses.

But in industrial-plant work, particularly where the fuses are used for the protection of small motors, and blow often, and where every minute has its value, they become important.

Referring to disadvantage No. 1, it is necessary, if a good contact is to be provided, that the spring clip fit the fuse ferrule snugly and it usually does when the cut-out is first installed. Some of the metal used by manufacturers, doubtless in an effort to provide a good contact pressure, is exceedingly stiff. It requires considerable pressure to force the fuse into such clips, as shown in Fig. 3, and it is often impossible to remove the fuse with the fingers. From Fig. 3 it is apparent that to remove or replace a Code fuse of less than 60 amp. capacity the clips must be forced considerably from their normal positions, and the little clips sometimes resist displacement stubbornly. This gives more trouble with the 0-30-amp fuse (see Fig. 2) than it does with the 31-60-amp size because the smaller diameter of the fuse of less capacity makes it difficult to grasp The condition becomes aggravated when one's hand is oily, as it frequently is when motor repairs are being made. The 31-60-amp fuses are not at all easy to remove when the contact springs are of stiff metal.

Obviously either size of fuse can be pried out easily, but the repair man uses the tool most convenient, which is usually either a metal screwdriver or a pair of pliers. If the tool slips then, as sometimes happens, two legs of the circuit may

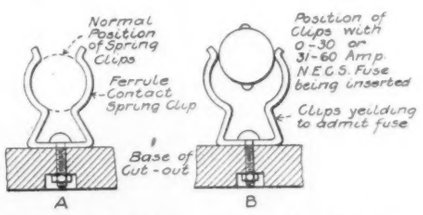

Normal Position of Spring Clips
Ferrule Contact Spring Clip
Base of Cut-out
A
Position of Clips with 0-30 or 31-60 Amp. N.E.C.S. Fuse being inserted
Clips yielding to admit fuse
B

Fig. 3—Showing How Clips Must Yield.

be short-circuited and a larger main fuse, the one that protects the panel box, disrupted. It is certainly unwise to use equipment which encourages the introduction of metallic tools into "live" panel or switchboxes.

Disadvantage No. 2 follows directly from disadvantage No. 1. A repair man in replacing a blown fuse has difficulty in removing the old one—it may be that he has no tools with him and has to pry out the old fuse with a stick—and he thinks that the clips fit too tightly. He corrects the trouble by prying he clips apart. Doubtless he pries too hard the first time—he is not a watchmaker—and then must bend the clips back again. After a trial or so he adjusts them to his satisfaction and inserts a new fuse. The motor or other apparatus is tested. It operates and the repair man leaves. Shortly after the motor gives trouble and another repair man, after some delay, locates the fault. It is a loose connection in one of the fuse clips. The new man endeavors to adjust the clips according to his ideas and in doing so one of the clips is broken off at the point *A*, Fig. 1. This does not happen very often, but it does happen often enough to be a very disagreeable characteristic of the National Code standard 0-30-amp and 31-60-amp cut-outs. Contact fingers in these cut-outs formed from very soft metal are occasionally bent sufficiently out of shape by merely inserting and removing fuses that loose connections result.

Disadvantage No. 3 also is probably not of much consequence in residence, store or office-building installations because one in replacing a fuse in such installations seldom stands on a

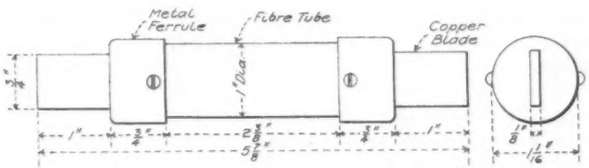


Fig. 4—National Fuse Code 61—100 amp.

grounded cement floor, cast-iron floor plate or steel roof truss. But the repair man in an industrial plant often does. From Fig. 2 it will be noted that there is but 1 in. clearance between the "live" end ferrules on a 0-30-amp fuse. This is not sufficient for the fingers of a burly electrical repair man or for the fingers of one that is not burly as many can testify. In replacing or removing one of these small fuses the fingers are apt to touch one or the other of the ferrules, and if the manipulator is "grounded" he gets a shock. He would not if the system were free from grounds, but it seldom is. If not grounded through faults, it is usually permanently grounded through the ground detector.

Such a shock is not fatal, but the one that a 250-volt alternating-current circuit gives is not at all pleasant. It is sufficient to cause the arms and body to twitch and to cause the man to loose his balance and fall if he stands in an awkward position. Such an accident might, with the man working on a roof truss 30 ft. above the floor line, result seriously. Some types of Code 0-30-amp cut-outs have their porcelain bases so molded that it is difficult for fingers to touch line metal parts,

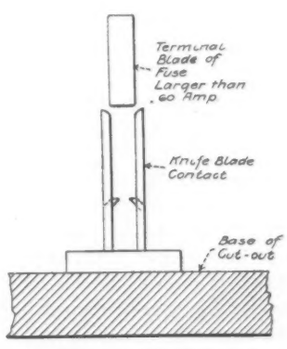


Fig. 5—Fuse Clip for National Code Fuse Larger Than 60 amp.

but in other designs, that for instance shown in Fig. 1, no protection is afforded.

None of these disadvantages outlined above holds for National Code fuses of capacities above 60 amp (see Fig. 4 for typical design), nor for their fuse holders, of which a typical end view is shown in Fig. 5. Such fuses have knife-blade contacts. They can be removed and replaced easily because their diameters are such that the fingers can grip them. No trouble due to loose connections or broken contact fingers is experienced. Because of the knife-contact blades (see Fig. 5) the fuses can be inserted and removed with comparative ease. The blades move but slightly when a fuse is taken out or re-

placed. Wiremen and repair men do not endeavor to alter the adjustment of the knife-blade contacts because they can readily manipulate the fuses in them without such adjustment. Shocks are not liable to be received through the knife-blade contact fuses because the ferrules have ample distance between them. In the smallest size, 61-100 amp, shown in Fig. 4, this distance is 2⅜ in. For capacities exceeding 60 amp the situation is well taken care of.

Where a fusible cut-out having a capacity of less than 60 amp is required on a circuit having a voltage of less than 250, the combination of an Edison plug cut-out (see Fig. 6), a National Code fuse (see Fig. 2) and an Edison fuse-plug casing (see Figs. 7 and 8) provides an equipment having none of the three disadvantages tabulated above. But the Underwriters approve this combination only for 0-30 amp not exceeding 125 volts. What their reasons are for withholding approval on the combination for 0-60 amp not exceeding 250 volts, the writer does not know.

Edison plug cut-outs like that shown in Fig. 6 have, in the past, been made in two sizes, as were the Edison fuse-plug casings. The smaller cut-outs accommodated the smaller casing, which in turn fitted a 0-30-amp National Code fuse. The larger combination took a 31-60-amp National Code fuse. Both of these fuses are approved for service at 250 volts or less.

Fig. 8 shows clearly the construction of the casing, and Fig. 9 the manner in which a fuse rests in it. The casing consists essentially—the actual construction is different in different makes—of a porcelain hollow cylinder, to enclose the fuse, having at its bottom a screw-thread formed from sheet metal, which meshes into the corresponding thread in one of the sockets of the cut-out. The screw-thread at the bottom of the casing connects electrically with a metallic lining at the top, on the inside of the casing. The casing screwing, as it does, into the cut-out socket effects excellent pressure contacts between the lower ferrule of the fuse and the brass contact button

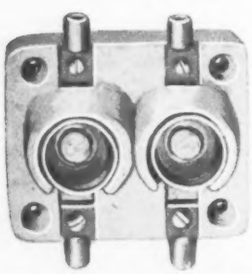


Fig. 6—Double-pole Edison Plug Cut-out.

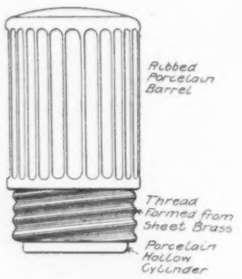


Fig. 7—Edison Fuse Plug Casing.

(shown in Fig. 6 at the bottom of each of the sockets) and between the metallic top lining of the plug and the top ferrule of the casing of the fuse. When the casing is screwed into position the thread and the button in the socket of the cut-out, and consequently the top and bottom ferrules of the fuse in the casing, connect to the two cut-out binding posts located on the same center line as the socket. "Live" parts of the fuse are not exposed when the casing is screwed into its position. The outer surfaces of the better casings are corrugated, as shown in Fig. 7, so that they can be easily removed from the cut-out with the hand, although it may be oily or enclosed in a greasy glove.

Disadvantage No. 1 does not obtain with the Edison plug cut-out fuse-plug casing-fuse combination because a tool is never required nor can one, so far as the writer knows, be used in removing the fuse-plug casing from the cut-out. There is no occasion for introducing a metallic tool into the panel box. To remove the fuse from the casing a nail, a piece of wire or a stick is inserted through the hole in the top of the casing to start it. This operation is performed, after the casing is removed from the panel box, where there is no danger of short-circuiting.

Disadvantage No. 2 does not obtain as there is no member that can be bent. The pressure contact effected by screwing the casing into the socket is excellent.

Disadvantage No. 3 is out of the question where the cut-out casing-fuse combination is used because the fuse is wholly encased in porcelain. Clearances are ample and accidental contacts between the hand and "live" portions are inexcusable. When an Edison plug cut-out of the form shown in Fig. 11, which has a porcelain protecting cover, is used accidental contact and shock are practically impossible.

The device shown in Fig. 9, which is known as the "Edison plug fuse," is approved for 0-30 amp at not exceeding 125

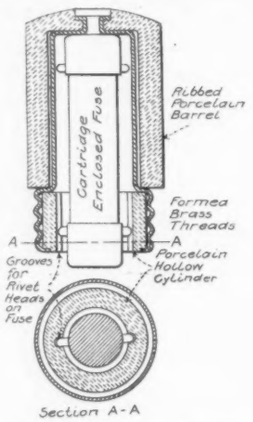


Fig. 8—Sections of Fuse-Plug Casing.

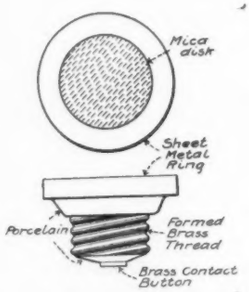


Fig. 9—Edison Fuse Plug.

volts. This places it, although it is decidedly inferior, in the same class with casing-fuse combinations, where it does not seem to belong. The same enclosed fuse used in the casing-fuse combination is rated and with approval used in a cut-out like that of Fig. 1 at 250 volts, but its use is not permitted at that pressure when it is further enclosed in a porcelain container which permits the fuse to be used in a cut-out that provides good contacts and lessens liability to shock.

The plug fuse of Fig. 9 is certainly not to be recommended

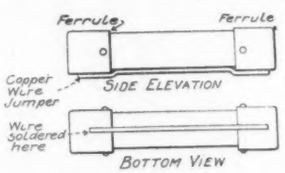


Fig. 10—Copper Jumper Soldered on Fuse.

for use at 250 volts. The break distance is too short for that pressure. It may be that this device, although for some time it has been approved for only 125 volts, found its way into 250-volt cut-outs and the Underwriters to guard against this limited all Edison plug cut-outs to 125 volts. But this does not account for the elimination of the 31-60-amp Edison plug cut-out.

It might be argued that fuse-plug casings are dangerous be-

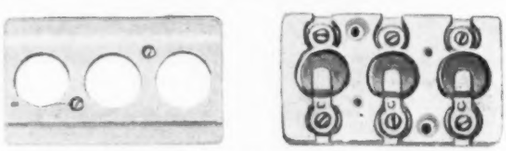


Fig. 11—Protected Edison Plug Cut-out.

cause pieces of metal—dummy fuses—having carrying capacities much in excess of the rating of the cut-out might be concealed in them. Dummy fuses can be and are thus used in fuse-plug casings. But they are also used in the National Electrical Code cut-out shown in Fig. 1. A jumper of copper wire of ample diameter is soldered, as shown in Fig. 10, from ferrule to ferrule of a blown fuse. The dummy fuse is inserted, with the copper wire toward the base of the cut-out, so that its presence is not easily detected. It is not really necessary to solder the wire to the fuse. An expert can so wedge

it between the ferrules of the fuse and the contact clips that it will carry the load and not be readily discerned.

It is a fact that the Edison plug fuse of Fig. 9 is not capable of safely operating at pressures in excess of 125 volts. But if this has been taken as a reason for limiting all Edison plug cut-out combinations to that pressure it does not seem fair. In the opinion of many the Edison plug cut-out casing-fuse combination is, for capacities below 60 amp, a much better equipment than is the standard cut-out fuse combination for either 125 volts or 250 volts.

LETTER TO THE EDITOR.

The Fallacy of Using Too Large a Centrifugal Pump.

To the Editor of Electrical World:

SIR:—The fallacy of using a thing too big for the purpose just for the sake of having it large enough on the assumption that it is better to have it too big than too small is well illustrated in the case of an engineer who selected a centrifugal pump for a higher head than was actually required with the idea in mind that if the pump was built to deliver water against a high head, it would surely be large enough to use on any head lower than that at a corresponding saving in power.

A centrifugal pump is in some respects like a shunt-wound generator; it generates constant pressure which must be entirely consumed by friction of water in the pipes and counter-pressure due to static head. If the latter is decreased the friction in the pipes must increase by an amount sufficient to compensate therefor; that is, the flow of water will increase until the friction developed is great enough to absorb the excess pressure. To carry the analogy further, the pressure developed by a pump is essentially a function of the speed, and wherever the head is varied, it should be done by varying the speed of the pump. However, if this is impracticable a valve should be inserted in the pressure pipe and adjusted until the proper reading is obtained upon a pressure gage in the delivery pipe of the pump.

The overloading of centrifugal pumps due to application under too low a head is similar to the operation of a generator on too large a current, and in extreme cases its effect is similar to a short-circuit. For instance, a centrifugal pump delivering into a long pipe will stall the motor and probably blow the fuses if the pipe is suddenly broken off close to the delivery. A centrifugal pump will operate efficiently over a considerable range of head, providing the flow of water is maintained near the rated capacity of the pump, either by the use of a valve or by changing the speed of the pump. Therefore, where a mistake has been made or where it is desired to operate a pump at a head different from that for which it was designed, efficient operation can be obtained by the use of a valve or by changing the speed. Ignorance of these simple facts has often caused the rejection of a pump, and in some cases necessitated doubling the horse-power of the driving motor in order to carry the excess load due to reduction of head. It is not an easy matter to measure the flow of water and a pump is liable to considerable overload without any one being any the wiser, except that the motor takes an abnormal amount of energy to operate it.

Buffalo, N. Y. DAVID MORRIS.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Cascade Converter.—H. S. HALLO.—The conclusion of his long illustrated article on the cascade converter. In the present installment the author deals with its use for the supply of energy to three-wire networks. The arrangement is similar to the old three-wire dynamo of Dolivo-Dobrowolsky, but is simpler and without any complications. The slip rings which are needed for starting may be used for the current of the neutral wire. If the balancing current is not very large, the neutral wire may be connected with a single switch to one of the slip rings. If the balancing current is large, however, it is preferable to subdivide it over the brushes of all the slip rings. This may be done with the aid of a three-pole switch as indicated in Fig. 1,

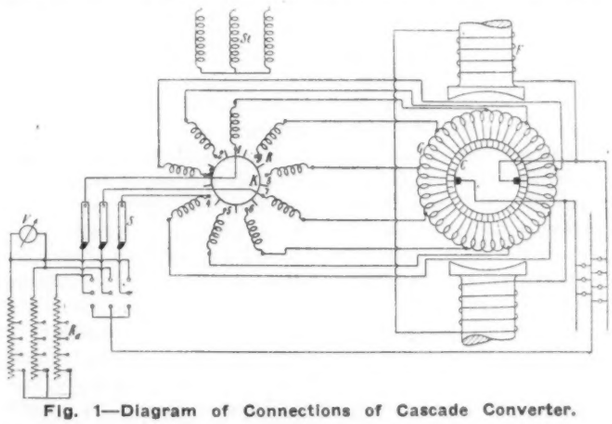


Fig. 1—Diagram of Connections of Cascade Converter.

which shows all the connections. In this case the balancing current does not pass through the contacts of the starter. Moreover, there is no voltage impressed on the starter during operation. There are a large number of cascade converters in operation on three-wire systems, and it has been found that the voltage difference between the two halves of the network is about 0.5 per cent of the voltage between the outers if the balancing current is 20 per cent of the full-load current. If the balancing current is 50 per cent of the full-load current, the voltage difference between the two halves is 1 per cent of the voltage between the outers. Sometimes it is desirable to increase the voltage of the half which is overloaded to compensate for the voltage drop in the feeders. In this case it is necessary to use a series-wound booster, which may be directly driven from the axle of the cascade converter.—*Elek. Zeit.*, June 16.

Efficiency Tests.—J. F. FORREST.—The author recommends the methods of analysis of results of the Hopkinson efficiency test given in a paper by Drysdale, which was recently abstracted in the Digest. As to the differences in the efficiency between motor and generator action he emphasizes that it is a real one, and is an inherent feature of the efficiency curves of any machine. For any given output, the armature current of a generator can be divided into useful current and exciting current, while that of a motor consists of useful or working current and "losses" current. The "losses" current when running as a motor will generally be greater at the same output, thus the motor armature current and I^2R loss will be slightly higher than those of the generator. He finds that this agrees with the figures of about 1 per cent in Drysdale's numerical example. Drysdale replies that Forrest's remarks about the armature losses are correct in principle, but they do not exhaust the problem, since the error introduced by wrong apportionment of the iron losses is not insignificant.—Lond. *Electrician*, June 17.

Lamps and Lighting.

Indirect Illumination.—BLOCH.—The author claims that indirect arc-lamp illumination is not as uneconomical as is often alleged. Indirect arc-lamp illumination is far more economical than illumination with carbon incandescent lamps, and if the arc lamps with reversed position of the carbons are used, indirect arc-lamp illumination is also more economical than matallic-filament lamp illumination. If arc lamps are used with the usual position of the carbons, indirect arc-lamp illumina-

tion is about as economical as metallic-filament lamp illumination. Indirect arc-lamp illumination with reversed carbon position requires from 14 to 18 (in the average 16) watts per lux of average illumination and 100 sq. m area of the ground. If arc lamps are used with the usual position of the carbons the power consumption is 22 to 28, and in the average 25 watts. Large rooms lighted by indirect illumination may look cold on account of the absence of shadows. For this reason a semi-indirect illumination system may be used. Another way is to use indirect illumination of the walls by means of specially constructed arc lamps. The light is thrown onto the walls between the windows and reflected from them and illumination of this kind is almost exactly the same as the illumination obtained by daylight through the windows. The quartz mercury-vapor lamp is specially suitable for indirect illumination. The power consumption is about the same as with arc lamps with reversed carbon position, but the quartz lamp has the advantage that the length of its life is 1000 hours and that the light is absolutely quiet. Such an illumination is specially good for draughting-rooms.—*Allgem. Elek. Ges. Zeit.*, Vol. 12, 1910, page 12; abstracted in *Elek. Zeit.*, June 16.

Street Lighting.—J. Abady.—A paper read before the Institution of Gas Engineers in London, reviewing the question of municipal street lighting, both by electricity and gas. He did not touch upon the controversy between the two systems, but confined his remarks to a discussion of forms of contract and the size, spacing and arrangement of lamps to obtain good illumination. He favors charging for the actual light rather than for the energy supplied and points out the advantages of small units close together.—Lond. *Elec. Eng'ing*, June 16.

Tungsten Filament.—A note on a recent British patent of C. H. Weber (18,808, 1909; June 9, 1910): In order to render tungsten filaments less brittle, a small percentage of tellurium (a brittle metal vaporizing at 1400 deg. C.) is added to the tungsten mixture before squirting. After the usual baking process, the filaments are heated in a reducing atmosphere at a red heat for a considerable time in order that the tellurium may melt and alloy with the tungsten. Firstly, the filament is raised to a bright red heat and most of the tellurium is vaporized. About 0.05 per cent tellurium is present in the finished filament, however, and this is about the amount which gives the toughest alloy. Selenium can be used instead of tellurium. Two other processes for obtaining the required alloy are described in the specification. It is stated that blackening is not accelerated, as the tellurium is retained by the filament, and the carbon content of such filaments is less than that of ordinary tungsten filaments.—Lond. *Eng'ing*, June 16.

Metallic Filaments.—A note on a recent British patent (15,193, 1909; June 9, 1910) of Société Française d'Incandescence par le Gaz (System Auer). Filaments of vanadium, niobium or titanium are prepared by reduction from the oxides of these metals. The filaments are squirted from a paste of the oxides mixed with powdered metal and lampblack and, after being heated to make them conduct, are raised to a red heat in a suitable atmosphere to decarbonize them. Finally, the decarbonized filaments are reduced at a white heat (about 1800 deg. C.) in an atmosphere of hydrogen and ammonia to the metallic state. The decarbonizing and the final reduction can be performed in one treatment by the addition of a small percentage of an oxidizing gas to the hydrogen and ammonia.—Lond. *Elec. Eng'ing*, June 16.

Resistance Meter for Filament Lamps.—An illustrated description of a new ohmmeter specially designed for the use of incandescent lamp factories. The current is kept constant and the e.m.f. is measured with a precision voltmeter, which is directly calibrated in ohms. One of the special and carefully worked-out details of this instrument is the manner of mounting the filament to be tested.—*Zeit. f. Beleucht.*, June 10.

Generation, Transmission and Distribution.

Vacuum in Steam Turbines.—R. M. Neilson.—A paper in which the author deals with the question of the effect of variation in the terminal pressure on the economy of steam turbines, and, from a consideration of the available heat energy in steam and the constructional requirements in steam turbines, explains why the efficiency of a turbine is affected as it is by change in the terminal pressure. A curve is given from which the effect of such changes on the steam consumption of any turbine may be estimated.—Lond. *Electrician*, June 17.

Exhaust-Steam Turbines at Edinburgh.—F. A. Newington.—A (Brit.) Municipal Elec. Ass'n paper on the exhaust-steam turbines and condensing plant recently installed at Edinburgh. The most interesting feature is the use of sewage for condensing purposes. The capital cost of the installation and the reduction in the costs per unit generated are tabulated. The first row of figures refers to the year 1908, when only reciprocating engines were used without condensation. The second row of figures refers to the year 1910, with exhaust-steam turbines and condensation. In 1908 the price of coal was considerably lower than in 1910, but for the purpose of comparison the 1910 prices has been taken for both periods.

COSTS PER KW-HOUR GENERATED.

	1908	1910	Saving per cent.
Fuel	0.502 cent	0.334 cent	33.4
Oils and stores	0.018 "	0.008 "	50.0
Water	0.054 "	0.012 "	78.0
Salaries and wages	0.108 "	0.094 "	
Repairs (estimated)	0.114 "	0.114 "	
Total	0.796 cent	0.562 cent	30.0

In the costs per unit generated for the 1910 figures the units used by the condensing plant have been deducted.—Lond. *Electrician*, June 17.

Mixed-Pressure Turbines.—A. Bremner.—An illustrated paper read before the (Brit.) Municipal Elec. Ass'n. The author describes the mixed-pressure turbines installed at Burslem, and gives particulars of the saving in works costs thereby obtained. He also mentions the saving obtained in other installations of mixed-pressure turbines, which latter he considers are an economical method of extending existing supply stations. For the mixed-pressure turbine installed at Burslem the following figures of works costs per kw-hour generated are tabulated to show the gain (32 per cent) due to installing the turbine. The calorific value of the coal is 12,700 lb-Fahr. units per pound and its cost per ton $1.81 into bunkers.—Lond. *Electrician*, June 17.

	Reciprocating Sets only, April, 1909.	Combination of turbine and reciprocating sets. April, 1910.
Coal	0.488 cent	0.368 cent
Water	0.142 "	0.056 "
	0.630 cent	0.424 cent

Air Pump for Exhaust Turbines.—In the discussion on mixed-pressure turbines before the (Brit.) Municipal Elec. Ass'n, I. V. Robinson described a kinetic air pump of a new type. One of these pumps had been in operation for some eight months and was able to maintain a steady vacuum of 29 in. on a 750-kw turbo-plant. The air and vapor were drawn from the condenser under the action of a steam jet, and, together with the steam, were met by a water spray, which condensed the added steam of the jet. The ejector water was then encountered and the combined flow delivered to the discharge pipe. Fig. 2 shows a sectional arrangement and assembly plan of the kinetic pump. The left-hand diagram is a section of the kinetic air ejector. 1 is the steam inlet; 2 a steam nozzle; 3 air and vapor condenser; 4 steam jet, air and vapor combining tube; 5 non-return valve; 6 spray-water inlet; 7 spray-water holes; 8 spray-water driver; 9 spray-water combining tube; 10 water jet inlet; 11 water jet adjustable nozzle; 12 water jet combining tube; 13 main discharge to tank. The right-hand diagram shows the general arrangement of the kinetic air pump. The letters in it have the following meaning: Condenser water: *B* head pump section; *C* head pump dis-

charge; *D* equilibrium pipe to condenser; *E* pressure pump suction; *F* pressure pump discharge to tank. Air from condenser: *G* steam jet air suction; *H* steam jet; *J* steam jet discharge to water ejector; *K* kinetic pump suction from tank; *L* kinetic pump discharge to spray; *M* kinetic pump discharge to jet. The complete arrangement included a circulating pump for the spray and ejector water and a two-stage centrifugal pump. With the latter the first stage is connected to the condenser from which the condensed steam water, over and above the air and vapor, which are removed by the steam jet, is

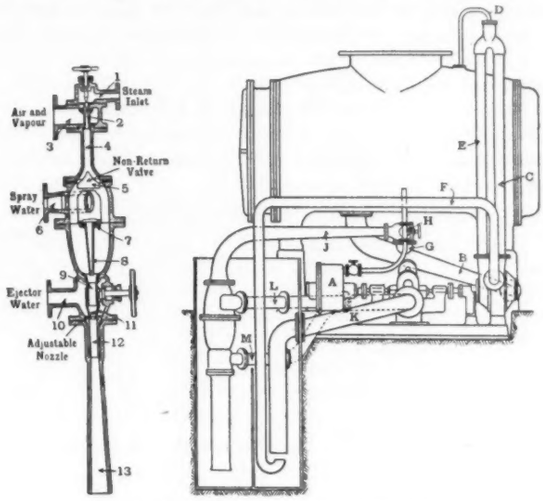


Fig. 2—Air Pump for Exhaust Turbines.

withdrawn and delivered against a static head of 8 ft. into a pipe, the top of which is connected to the condenser barrel. The connection ensures that the first stage of the pump (known as the head and pressure pump) shall discharge only against this head. Further a positive head is thus secured for the suction side of the suction stage of the same pump. This second stage discharges the condensed steam water to the pump surrounding the ejector, whence the boiler feed is drawn. In the right-hand drawing the two pumps are shown driven by a small Curtis turbine. The pump dealing with the water spray and jet keeps this water constantly circulating from the pump. The advantage of the arrangement was that the latent heat in the steam jet was not given up to the circulating water as in the case of a vacuum augmenter, but to the hot well, which was raised to a temperature 10 deg. or 15 deg. above the temperature corresponding to the vacuum. The apparatus ran with the minimum of attention, being entirely rotary with ring-oiled bearings; there was but a single pumping unit, and the space occupied was extremely small.—Lond. *Electrician*, June 17.

Transmission Plants for Agricultural Districts.—R. MEIER.—A paper read before the Verband deutscher Elektrotechniker. The results so far obtained in Germany with electric transmission systems in agricultural districts show that only those are economical which supply industrial works requiring a large amount of power, or which supply both industrial works and agricultural plants. On the other hand, transmission plants in a purely agricultural district are not able to make a good profit on account of the very high first cost per useful kw-hour sold. Statistical data are given to prove these facts.—*Elek. Zeit.*, June 16.

Belgium.—J. IZART.—In the first installment of an article on electricity in Belgium, the author discusses electric installation in coal mines, and deals especially with the different systems for electric winding so as to overcome the troubles of the large fluctuations of load.—*L'Industrie Elec.*, June 10.

Traction.

Reduction of the Weight of Traction Motors.—An editorial emphasizing that more attention should be paid to the reduction of the weight of traction motors. For example, it is said that by using oxidized aluminum instead of fiber insulated copper for field coils, the Hamburg (Germany) Street Railway saves about 100 lb. per 40-hp motor and incidentally eliminates those short-circuits arising from charred insulation. Another place for reduction is in the gear case. The possibilities of using special steel like vanadium steel are also mentioned.—*Elec. Rail. Jour.*, June 10.

Installations, Systems and Appliances.

Voltage Regulator.—J. REYVAL.—In an article on the recent exhibition of instruments and apparatus of the French Physical Society, the author describes the voltage regulator of Routin. The object is to maintain constant the voltage supplied by a generator by varying the exciting current. Fig. 3 shows the connections. 1 is the beam of a balance, suspended on a point 2. The movable coil 3 is suspended from one arm of the balance and is acted upon by the magnetic field created by the coils 4 and 5. The coils 3, 4 and 5 are in series with an auxiliary resistor 6, and this circuit is connected to the terminals of the generator the voltage of which is to be regulated. 7 is a counterweight, and further adjustment may be made by means of the spring 9 and the screw 8. A silver-plated iron rod 10 is mounted on the beam of the balance, and is electrically insulated from it. When the arm of the balance sinks or rises, the rod 10 comes in contact with one or the other of two silver-plated steel wires 11 or 11'. The rod 10 can move freely in the interior of the fixed coil 12, which maintains it constantly magnetized for the object of sure and quick contact making and breaking. When the voltage of the generator is too high the force exerted by the two coils 4 and 5 on 3 causes the right arm of the balance to drop and contact is made between 10 and 11. Through the circuit of the electro-

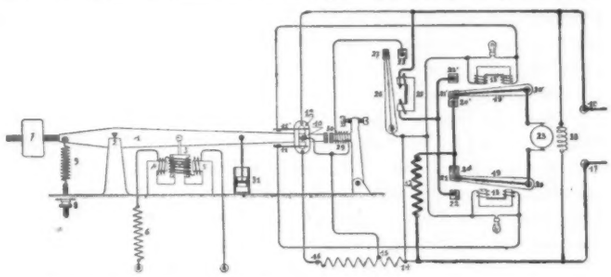


Fig. 3—Diagram of Voltage Regulator and Connections.

magnet 13 a current will then pass which is taken off between the points 14 and 15 of a resistor 14, 15 and 16, used as potentiometer and connected at 17 and 18 to a source of direct current. The electromagnet 13 attracts the armature 19, which revolves around 20. Contact is thereby made between the movable carbon piece 21 and the fixed carbon piece 22. The armature 23 of the motor, which operates the rheostat (motor with constant excitation, is then caused to revolve in such a direction as to diminish the excitation. As soon as the contact is broken between 10 and 11 the armature 19 is drawn back by means of a spring, not shown in the diagram, so that contact is made again between 21 and 24. The brushes of the armature are thereby short-circuited and the motor is stopped suddenly by means of electromagnetic braking action. When the voltage is too low the apparatus operates in an analogous way, the rod 10 now making contact with 11'. Other details of the apparatus, and especially the method of keeping the contacts intact, are described.—*La Lumière Elec.*, June 11.

High-Tension Switchgear.—A. C. EBORALL.—While the oil circuit-breaker constitutes to-day a highly important factor in the successful operation of large power plants, one is inclined to wonder whether finality has already been reached in this direction. The author thinks that for power plants of 100,000 kw or more it is doubtful whether we can rely solely upon the oil circuit-breaker—or upon any circuit-breaker—to deal satisfactorily with the enormous surges of energy that may arise from time to time. For such very large power plants the capital cost of protective gear which would give the same security

as is obtained in present stations would turn out to be prohibitively high. It is possible that the solution will be found to lie in the adoption (or partial adoption) of a type of generator that will have different characteristics from those of the present-day synchronous machine rather than in further improvements to oil circuit-breakers. Thus, if it were not for its high exciting current and inability to carry a wattless current, the asynchronous generator might well come into consideration in this connection, for, running in parallel with synchronous units, it ceases to generate under short-circuit, which in reality is what is wanted. Although at present this type of machine is nearly uncommercial (at any rate, in large sizes) it may be that it will undergo development before long.—Lond. *Elec. Eng'ing,* June 16.

Electricity Supply.—W. W. Lacke.—His presidential address to the (Brit.) Municipal Elec. Ass'n. He emphasized that municipalities have done much to advance the central-station industry. He then discussed the question of depreciation and made the following points: (1) Depreciation of value is met by the sums set aside for sinking fund, if such sinking fund be properly calculated upon the probable life of the plant. (2) Decreased efficiency should be met by depreciation if the ordinary maintenance chargeable to revenue is not sufficient to keep the plant in its first state of efficiency. (3) Obsolescence does not mean, nor does it involve, depreciation. It is not true depreciation, but it is quite possible that a prudent manager might look to the advantage which would be gained by installing present-day plant, and so getting greater efficiency than would be obtained from antiquated plant. Such a manager would annually lay aside a sum for this purpose and might be found dispensing with old plant in favor of something more up to date, even although the latter might not have reached the end of its usefulness. As to the supply of lamps, he thought that much could be said in favor of the manager providing the consumers with lamps. Frequently bad lighting is found to be entirely due to defective lamps. In the end it would be for the best welfare, not only of the central-station company, but of the wiring contractors, if the lamps (which, after all, are the means of transforming electrical energy into light) were left to the manager, either to be supplied and the price included in the charge per unit or sold direct to the consumer. If the former method were adopted one lamp might be given for every 100 or 200 units used, and if the latter, the price would be, at most, net cost. Finally, the question of rates was taken up and the author emphasized that in his opinion any flat rate adopted must be based on the maximum-demand system, or, in other words, on the load factor of each consumer, and where classification is possible, on the average load factor of any one class. The maximum demand would still be taken during the year, and the average rate worked out. This would mean that there should be different flat rates for different consumers or for various kinds of consumers, ranging from 7 cents to 1 cent per kw-hour, decreasing from the former to the latter by tenths or even hundredths of a penny; but each rate would be the result of fair and just computation. A rate committee might be appointed and sit once or twice a year to hear and settle cases in dispute.—Lond. *Electrician,* June 17.

Commercial Advancement of Electrical Supply.—A. C. Cramb.—A paper read before the (Brit.) Municipal Elec. Ass'n. The author urges the necessity of a vigorous campaign for developing the use of electrical apparatus, and indicates on general lines how this campaign should be organized.—Lond. *Electrician,* June 17.

Commercial Progress of Central Stations.—H. C. Bishop.—A paper read before the (Brit.) Municipal Elec. Ass'n. The author describes the commercial development of the Newport electric supply company during the past three years, discussing installation work, arc-lamp rental, rental purchase schemes, charges, gas competition, free wiring, installment plan wiring, etc.—Lond. *Electrician,* June 17.

Pushing the Sale of Electricity.—In the discussion of the two papers of Cramb and Bishop at the recent meeting of the (Brit.) Municipal Elec. Ass'n, F. Ayton expressed his intention of training lady canvassers in order to push the sale of domestic electrical apparatus. Some strong remarks were made in support of municipal wiring, and C. H. Wordingham was alone in advocating that electric supply companies should not do this work. Cramb and Ayton both advocated the policy of leaving the contractor out of the question altogether, the former saying that the present position was that the central-station manager should sell the apparatus and the contractor take the discount. Other speakers referred to the fact that while the wiring contractors had had the field to themselves for years, the sale of heating and cooking apparatus had never been pushed.—Lond. *Elec. Eng'ing,* June 16.

Earthing in Three-Phase Plants.—M. Vogelsang.—An article in which the author recommends the earthing of one outer lead (not the neutral point) to prevent dangerous rises of voltage and the advantages of this arrangement are briefly discussed.—*Elek. Zeit.,* June 16.

Aerial, Underground and Interior Circuits.

Conservation of Wooden Poles.—R. Nowotney.—The author gives the results obtained in practice during a series of years with wooden poles impregnated with zinc fluoride. This is far more effective than copper sulphate or zinc chloride. Zinc fluoride containing free acid ($ZnF_2.2HF$) is used. The method of impregnation and the time necessary are discussed; also the effect of concentration of liquid, the effect of temperature, etc. More recently experiments have also been made with "bellit," which contains mainly sodium fluoride and also some dinitrophenol and aniline oil.—*Elek. und Masch.* (Vienna), June 12.

Causes of Faults in Cables.—F. Fernie.—In a continuation of his long illustrated serial on electric cables, the author takes up the causes of faults and methods for preventing them. Faults may be classified into those of manufacture, those caused during laying, and those developed after the cables are laid. The last class is due to a number of causes, such as mechanical injuries, electrolysis and electric osmosis, chemical action, overloading and eccentricity, high temperature, abnormal pressures and static discharges. These causes are separately discussed.—Lond. *Electrician,* June 17.

Electrophysics and Magnetism.

Wave Detectors.—W. H. Eccles.—A paper read before the Physical Society of London on an oscillation detector actuated solely by resistance temperature variations. The experiments described are offered as additional support for the author's hypothesis of the mode of action of certain types of electrical oscillation detectors. This hypothesis suggests that in detectors constituted of a loose contact the energy of the oscillatory current through the contact is transformed into heat at the contact and warms the matter there sufficiently to change its electrical resistance and, consequently, the steady current through the indicating instrument. The principal deductions from this hypothesis were worked out and were illustrated by experiments on iron-oxide coherers in a former paper. The present experiments are on a detector of the so-called "crystal rectifier" type, from which, however, the possibility of thermoelectric effects have been eliminated. This detector consists merely of a loose contact between two pieces of galena—a substance which, according to the author's theory, ought, by virtue of its large negative coefficient of change of resistance with temperature, to be a very efficient detector of electrical vibrations. The experimental curves obtained from a galena-galena detector are: the steady current curve, the sensitiveness curve, and the power curve. The first has steadily applied e.m.f. as abscissas, and current through the detector circuit as ordinates. It proves to be a curve which in general rises slowly at first, then quickly, and then slowly again; but if the circuit be arranged to have but little resistance other than that at the contact, the curve may possess a negative gradient at the point of inflection. The chief difficulty met in obtaining these steady-current curves arose from the slow movements of heat through the mass of crystals—which have, of course,

small thermal conductivity. This difficulty was overcome, and the true character of the curves brought to light, by allowing a proper time interval for thermal equilibrium to be established before each galvanometer reading was taken. The sensitiveness curve had the e.m.f. applied to the detector as abscissas, and the power passed to the indicating instrument as ordinates, the intensity of the electrical vibrations being of fixed amount. It is a curve which rises to a maximum near the point of greatest slope of the former curve ,and thereafter descends slowly. The power curve has the power supplied to the detector in the form of electrical oscillations as abscissas, with the power passed by the detector to the indicating instrument as ordinates, the steady e.m.f. applied to the detector being the best value. This curve is a straight line. The properties of this "crystal rectifier" are, therefore, just such as are logically deducible from the fundamental fact that the contact possesses a negative resistance temperature coefficient.—Lond. *Electrician,* June 17.

Brownian Movements and Molecules.—J. PERRIN.—The conclusion of his paper in which the author reviews the different methods for calculating the number of molecules in a "molecular volume." The author's investigations of the Brownian movements have furnished him with three methods for determining the constant of Avogadro's law and the results agree among themselves and with the values obtained by other methods. The author concludes that molecules are real things. —*La Lumière Elec.,* June 11.

Electrochemistry and Batteries.

Carbon Cells.—I. TAITELBAUM.—An investigation of various carbon cells of the Jacques type. The author used fused caustic soda for electrolyte in his first experiments and later on concentrated sulphuric acid.—*Zeit. f. Electrochemie,* May 1.

Ozone.—HENRY.—An illustrated article discussing briefly the present methods of producing ozone by electric discharges and the applications of ozone for water sterilization and air purification.—*L'Industrie Elec.,* June 10.

Units, Measurements and Instruments.

Units.—The report, signed by Strecker, of the committee on units of the Verband deutscher Elektrotechniker. Communicated discussion is requested till the middle of January, 1911. Besides some general rules and recommendations, the following specific notation is recommended: Multiples and fractions $M = 10^6$, $k = 10^3$, $h = 10^2$, $d = 10^{-1}$, $c = 10^{-2}$, $m = 10^{-3}$, $\mu \times 10^{-6}$. Lengths: m (meter), km (1000 meters), etc., $\mu = 0.001$ millimeter. Volumes: l (liter), hl (100 liters), $\lambda = 0.000001$ liter, m^3 (cubic meter), etc. Weights: t (ton), g (gram), kg (kilogram), dg (0.1 gram), etc., $\gamma = 0.000001$ gram. Units of time: hour, st; minute, mn; second, sk. Work: m kg (kilogram meter), PS st (horse-power-hour, also P st or Stundenpferd), W st (watt-hour), k W st (kilowatt-hour). Power: PS or P (horse-power), W (watt), k W, not kw (kilowatt). Photometric units: HK (hefner candle), Lm (lumen), Lx (lux). Electric and electromagnetic units: A ampere, V volt, Θ ohm, S siemens, C coulomb, J joule, W watt, F farad, H henry, VC volt-coulomb, Wst watt-hour, VA volt-ampere, Ast ampere-hour, mA milliampere, k W kilowatt, μF microfarad, MΘ megohm. The report is accompanied by explanatory notes by K. Scheel and K. Strecker. —*Elek. Zeit.,* June 16.

Weston Standard Cell.—S. W. J. SMITH.—An abstract of a paper read before the Physical Society in London. In this paper the recent experiments of F. E. Smith on cadmium amalgams are discussed from the point of view of the modern theory of alloys. Theory and experiment alike suggest that there is no range at any temperature over which the e.m.f. of a Weston cell is absolutely independent of the percentage of Cd in the amalgam. Even if the materials are quite pure, the existence of surface energy must cause some variation. Within the range over which the e.m.f. is usually taken as constant the e.m.f. appears to rise very slowly with increase in the cadmium content. The rate varies, but is never more than a few millionth of a volt for 1 per cent C. From the data it seems possible also to discover the precise way in which the use of the richer two-phase amalgams may lead to variability of the e.m.f. of the Weston cell. The interpretation advocated is that the irregularities are due to electrolytic skin effects arising out of want of uniformity of composition of the surface grains. The probable reason why the temperature coefficient of e.m.f. of a Weston cell, always small, actually vanishes near zero Centigrade is indicated. An outline of the way in which the phase rule can be used to exhibit the nature of the incomplete equilibrium of the Weston cell is also given.—Lond. *Electrician,* June 17.

Electric Resistance Thermometer.—An illustrated description of an electric resistance thermometer specially designed for use in cold-storage houses. Its construction is shown in Fig. 4. Being enclosed in a brass tube, it is readily responsive to changes of temperatures and practically unbreakable. This instrument works on the Wheatstone bridge principle, the indicator being a combination of a galvanometer with a bridge of the Callendar and Griffiths type.—Supplement to Lond. *Electrician,* June 10.

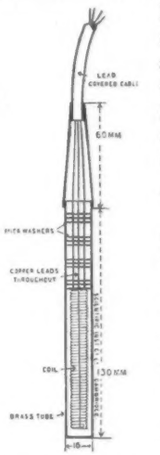


Fig. 4—Electric Resistance Thermometer.

Electric Thermometry.—A system of electric thermometry designed by an English firm for use in cold-storage houses, in magazines and in coal bunkers. Electric resistance thermometers are used mounted in a hollow metal tube. From each of these tubes a lead-covered cable is run to a distributing switch and the indicating instrument. The indicator is constructed upon the principle of the differential galvanometer with an electrical control. One of the differential windings (*X,* in Fig. 5) is shunted with a platinum thermometer, the other winding *S* being shunted with a resistor *s,* which is made variable so as to equal the resistance of the thermometer at certain fixed temperatures. The control coil of the ohmmeter system is also shunted with the resistor *d,* the resistance of which is determined by the degree of sensitiveness required and may be made variable with *s.* These shunted windings are connected in series, and the circuit is completed through a battery and switch. By using a differential winding (the currents in which are respectively due to the resistance of the thermometer and *s*) in conjunction with a control coil (in which the current is proportional to a selected difference unit *d*) the advantage is gained of making the indicator read on both sides of what would be the zero point in an ohmmeter of the usual construction, thus increasing the open length of the scale from about 45 deg. of arc to more than a right angle.

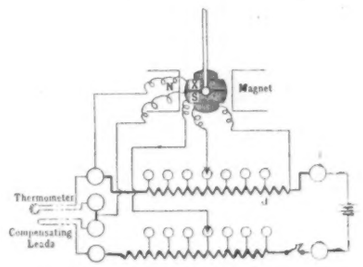


Fig. 5—Electric Thermometry.

Moreover, as the deflection is proportional to the ratio of difference of the currents in the differential windings to the current in the control coil, the sensitiveness for a given variation in the temperature of the thermometer may be made as large as desired by giving a suitable value to *d,* and is only limited by practical considerations.—Supplement to Lond. *Electrician,* June 10.

Electricity Meters for Double Tariff.—In recent years electricity meters have found favor in Germany which indicate on the same dial the consumption of energy for lamps at one tariff

and the consumption of energy for motors at another tariff. Of course, these meters do not indicate kw-hours or amp-hours, but directly the amount to be paid. This simplifies the matter for the consumer, but does not permit control by the station. Nevertheless, such meters have found use, especially in small installations. With the aid of diagrams various methods are described by means of which different types of meters may be arranged for the purpose indicated.—*Elek. Anz.*, June 12.

Pyrometers.—J. A. Fleming.—His second lecture before the Royal Institution on electric heating and pyrometery. The author briefly discusses the definition of temperature, and then describes resistance pyrometers, thermoelectric pyrometers and radiation pyrometers.—Lond. *Engineer*, June 17.

Exhibition of Instruments.—J. Reyval.—The conclusion of his illustrated article of various physical and electrical instruments for laboratory and industrial purposes exhibited at the recent exposition of the French Physical Society.—*La Lumière Elec.*, June 11.

Telegraphy, Telephony and Signals.

Wireless Telegraphy for Marine Intercommunication.—W. W. Bradfield.—A fully illustrated article. After discussing the advantages and progress of wireless telegraphy for marine purposes, the author describes in detail the Marconi plant used on board ship. This may be classified as transmitting, receiving and emergency apparatus. In conclusion, particulars are given of the number of naval and mercantile marine stations in operation in the various countries.—Supplement to Lond. *Electrician*, June 10.

Ships' Telephones.—H. S. Thompson.—An illustrated article in which he describes the general scheme adopted on board a ship, which from the telephone point of view may be looked upon as a large hotel. The instruments and other details, such as wiring and protection from stray currents, are next considered. Owing to the special conditions, at sea, such installations differ materially from those on land. For connecting a ship to a shore exchange a special flexible cable, with connecting boxes, is used.—Supplement to Lond. *Electrician*, June 10.

Miscellaneous.

British Municipal Electrical Association.—A very full account of the recent fifteenth annual convention of the (Brit.) Municipal Elec. Ass'n, held in Glasgow. The proceedings included a day trip to Edinburgh. The association now numbers 416 members.—Lond. *Electrician*, June 17, and other London electrical papers of the week.

Book Review

Pipes and Piping. By Herbert E. Collins. New York: McGraw-Hill Book Company. 140 pages, 75 illus. Price, $1.

This book is made up of articles taken from *Power* and forms one of the Power Series of handbooks. The scope of the work includes the calculation of strains and stresses and design of pipe circuits to resist the forces due to temperature changes; the installation and operation of piping; the arrangement of piping for complete power plants; the testing and selection of fittings and other information useful to the power-plant engineer. The book is just as valuable to operating engineers as to those who design and install the piping.

New Apparatus and Appliances

MOTSINGER ROTARY ENGINE.

The accompanying cuts illustrate a 5-hp rotary engine of a new type, made by the Motsinger Rotary Engine Company, Greensburg, Pa. The advantages claimed for this engine over the steam turbine are that it uses steam by expansion instead of by impact, operates economically non-condensing, is reversible and will start and carry a full load at low speed. With respect to the reciprocating engine, the claims are that as the rotors receive steam but once a revolution, it has a double expansion ratio; that it has a greater speed capacity and less vibration, is more compact, simpler to install and requires less attention running; and having no dead-points a flywheel is not required unless the cut-off is very short, while there is less friction owing to the absence of sliding surfaces, connecting and eccentric rods. The engine is easily reversed, responding to the movement of the reversing lever almost instantly.

Fig. 1 shows the engine direct-connected to a 3-kw generator, and the parts disassembled are shown in Fig. 2. There are three rotors, two of which are male and have vanes running the full length of the cylinders; the third is female and is grooved to receive the vanes of the male rotors. The rotors are 2¼ in. in diameter and 7 1/16 in. long. The vanes are 9/16 in. in height and fit exactly in the female rotor. The vanes of the male rotors are set 180 deg. apart, which allows them to run alternately in the female rotor. Balance is maintained by taking out metal from the male rotor on the vane side and from the opposite side of the groove on the other rotor, which equalizes the centers and eliminates vibration.

The rotors are fitted in a cylinder which has three bores, all of which are made 0.001 in. larger in diameter than the rotors. The two outside bores are made to fit the vane rotors, the middle bore being for the grooved rotor. The rotors are held in exact position by bearings placed in the cylinder heads, which cover the ends of the cylinders and hold the rotors in close contact with each other. These bearings, which are made of bronze, are 3⅛ in. in length and 1¼ in. outside diameter; 9/16 in. from each end are cut slots 1/16 in. wide and extending half way around the bearing. A connecting slot 1/16 in. wide joins these vertical slots at each end, making a flexible tongue of metal that can be pressed in by means of a spring gib and set screw to take up any play that might be caused by wear. The spring gib fits in a cored hole in the cylinder head and rests against the tongue of the bearings.

The vane and grooved rotors are geared together, the gears

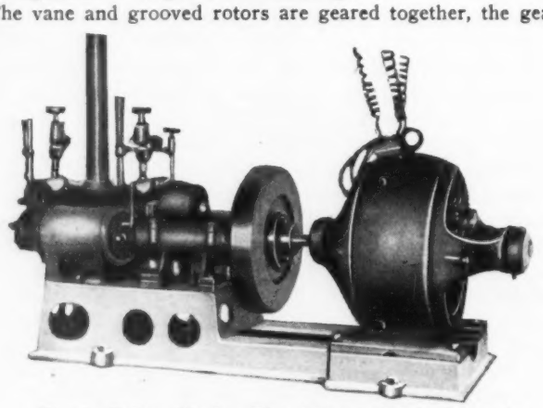


Fig. 1—Rotary Engine Direct-Connected to Generator.

being immersed in an oil bath. The female rotor shaft extends beyond the casing and carries a flywheel.

On the top of the vanes, and set 90 deg. apart on the female rotor, are T-shaped grooves running the full length, which are fitted with T-shaped strips of metallic packing. Springs are inserted under the strips and hold the packing in close contact with the cylinder bore. The ends of the rotors are packed with rings inserted in the ends, into which packing strips are

inserted. Both rings and packing strips are held outward by springs. The steam enters the engine at the bottom of the cylinder and passes around the cylinder in cored spaces, which also act as a steam jacket, and then enters the middle of the reversing valve, which is immediately over the rotors. From this valve it passes into the cylinder heads, and then to the rotors. The cut-off valves are made 90 deg. to 185 deg. long, as desired, and the steam expands until the rotor vanes reach the exhaust ports in the cylinder heads at the opposite end of the cylinder, whence the steam enters the rotor chamber. From

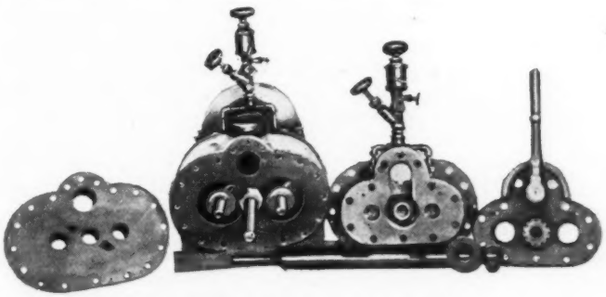


Fig. 2—Dissembled Parts of Rotary Engine.

this cylinder head it passes back to the reversing valve and goes to the atmosphere or condenser.

The reversing valve runs past the exhaust chambers of the two cylinder heads, and then is reduced for the governor and the reversing lever. The valve is cored with the exception of a partition between the two live-steam entrance ports at the middle of the valve. These two ports are directly opposite each other, and the partition makes one port communicate with one cylinder head to carry off live steam, while the other port communicates with the other cylinder head to receive the exhaust steam, and vice versa. The inlet and exhaust ports for one rotor are on the same side but at opposite ends of the valve. The exhaust ports are back of the cut-off plates, there thus being very little back pressure. The cut-offs to each engine are separate and distinct. The longest cut-off possible is 270 deg. for either engine. This allows no expansion. A cut-off of 90 deg. is the most economic.

The live steam is governed by an automatic cut-off governor formed by attaching centrifugal balls to two double-ported sleeves surrounding a port in the reversing valve, which sleeves are geared to the main shaft of the engine or female shaft by gears that open and close ports in the reversing valve, and with the centrifugal balls control the size of the steam ports of the reversing valve in accordance with the load.

In a test recently made at the U. S. Naval Academy, An-

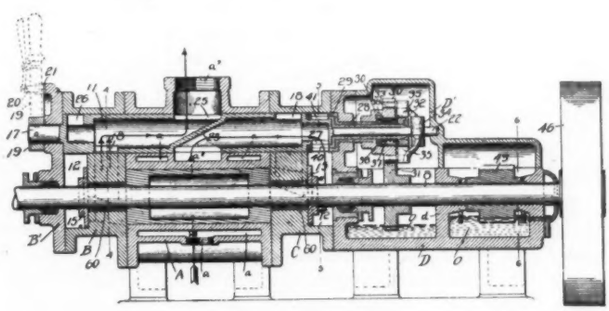


Fig. 3—Longitudinal Section of Engine.

napolis, Md., a 5-hp engine was worked to a load of 7.3 hp. Five sizes of the engine are now being built, namely, 5 hp, 10 hp, 20 hp, 40 hp and 80 hp, the speed being respectively 1200 r.p.m., 1000 r.p.m., 900 r.p.m., 750 r.p.m. and 600 r.p.m., with a steam pressure of 100 lb. The steam consumption is claimed to be as low as that of any simple engine of the same speed and power. The engine has also been applied to centrifugal pumps with the highest satisfaction.

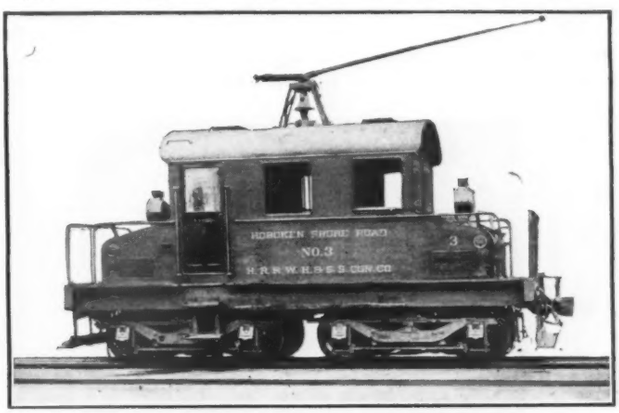
ELECTRIC SWITCHING LOCOMOTIVE.

The Hoboken Railroad, Warehouse & Steamship Company has had in operation since May, 1906, a 60-ton electric switching locomotive the continuous and economical performance of which under varying and severe load conditions has caused many very favorable comments in railroad circles. This locomotive has not only supplied the demand made most urgently by operating men that the service be perfectly reliable, but has been operated continuously at a maintenance cost that is exceedingly low.

Since the electric locomotive was placed in operation four years ago there has not been replaced a single contact on the switch group or a contact on the master switches or reverser. On the control apparatus nothing other than two tips on the live switch has been replaced. The brushes that are in the motors at the present time have been operating 14 months, and the master mechanic believes they will operate at least six months longer without replacement. No trouble has been experienced with broken brushes. Except that there has been replaced one pinion which was broken when a lock washer dropped into the gears, no repairs on the motor have been necessary.

The cost of inspection and cleaning has been practically nothing. Every Saturday morning the man operating the locomotive makes an inspection of the equipment. With compressed air he blows out the motor and the various parts of the control apparatus, and cleans any part that may need it with a piece of cloth. This work is not charged to maintenance, as the operator in doing it is simply filling in his time. No extra time is needed for maintenance or inspection.

The locomotive has a running and a starting drawbar pull of 14,500 lb. and 30,000 lb. respectively, and has a normal speed of



Electric Switching Locomotive.

12 miles an hour. It has four 100-hp, slow-speed motors, a hand-operated unit switch control, and Westinghouse air brakes and compressor. The electrical equipment was furnished by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; the mechanical parts, the steel cab and the trucks were built by the Baldwin Locomotive Works. The Hoboken Company stated that there never has been a time when the locomotive refused to work or would not do the work required of it. It averages 12 hours a day of shunting service very nearly every day in the year.

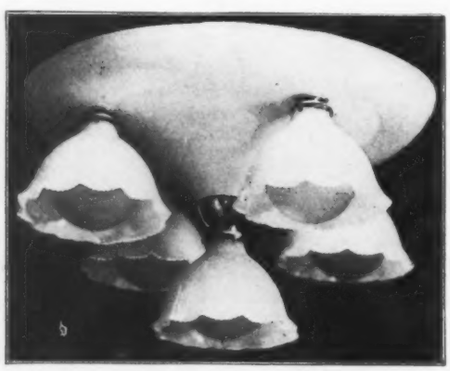
REMARKABLE PERFORMANCE OF INDUCTION MOTOR.

The performance of apparatus under exceptional circumstances reveals the weak or strong points in its design, and its suitability for the service for which it has been installed. Due to the fact that many manufacturers design their apparatus with a large factor of safety, remarkable records are sometimes made. A 20-hp, three-phase, 220-volt standard induction motor made by the General Electric Company recently demonstrated the ability of the standard motors manufactured by this company to operate successfully under the trying conditions met

with in mines, where the air is very damp, without their being totally enclosed. This is of great importance, as thorough ventilation of the motor is absolutely necessary due to the high temperatures which prevail in mines. This motor is geared to a mine pump located at the bottom of the shaft at the mines of the Richmond Iron Works, Richmond Furnace, Mass., and is installed in a chamber where the air is always very damp and moisture is continually dripping from the roof timbers. It is protected from this water by a piece of tarred paper tacked above it, so as to conduct the water away. During a heavy thaw last January, the surface water broke in on one of the upper levels and flooded the mine. The water rose so rapidly that the electric pump was soon under water, the top of the motor being 2 ft. below the surface. Under such circumstances it was imperative that the pump should continue in operation as long as possible, and so it was not shut down. It continued to operate and at the end of two hours, during the whole of which time the motor was submerged in water, it had pumped itself clear of water. It was then stopped only long enough to clean the dirt and chips from around the rotor and put oil on the bearings, and then was started up again. This pump has been running about 20 hours a day ever since and the motor has apparently suffered no injury from its unusual experience.

TUNGSTEN GROUP REFLECTOR.

The "Deflectolier" tungsten fixture shown in the accompanying illustration comprises a highly reflecting and diffusing enamel deposited on the surface of a metal disk of such theoretically correct curvature that the light from the units mounted in its receptacles will be distributed uniformly in all directions. The fixture is arranged for five 60-watt tungsten lamps, four in the curved surface and one pendent from the stalactite at the center of the reflector. Its arrangement secures the maximum useful distribution of the light from these units, making



Tungsten Group Reflector.

the fixture a valuable ally in replacing Welsbach incandescent gas arcs and other competitive fixtures. The makers state that for replacing an arc lamp the Deflectolier unit will benefit both the consumer and the central-station company, for although the tungsten group itself requires less energy, the superior quality and distribution of its light will result in the installation of more units, bringing the total up to an amount in excess of the original consumption. The Deflectolier is manufactured by Edward J. O'Beirne & Company, Elgin, Ill.

STRAND MESSENGER WIRE GRIP.

The grip shown herewith has been designed by Mathias Klein & Sons, Chicago, Ill., to handle strand or messenger wire without injury to the strands. The grip consists of a body or retaining piece, in which two steel wedge-shaped jaws move longitudinally. These jaws are arranged to move in either direction simultaneously, so that they open or close in unison. The gripping surface of the jaws is concave, and is provided with a series of milled teeth. These grip into the spirals of the strand, and being uniformly distributed over the entire length of the jaw, grip the wire at many points, so that no undue strain is brought to bear at any one point. The tackle is attached to the two oblong rings in the body piece, which being arranged centrally insure a straight pull. The proportions of

Strand Messenger Wire Clip.

the various parts are calculated to carry any strain that is necessary to tighten the wire, and the jaws are self-adjusting. The device is made in three sizes for messenger wire, and in two sizes for trolley wire. In the latter grip the jaws are not serrated, but only roughened.

DETROIT INDUSTRIAL EXHIBITION.

A successful industrial exhibition is being held in Detroit in special buildings erected for the purpose adjoining the Wayne Garden, a large part of the latter being also used for exhibits. The show is being given under the auspices of the Detroit Board of Commerce, principally with a view to booming the interests of the city in a business way, and only Detroit manufacturers are allowed to exhibit their products. The buildings are illuminated by the Elblight system in multiple series, placed 15 in. apart, 18,000 lamps being used in the installation. The electrical installation was installed in 14 days, which is considered a record for the amount of work necessary. There is ample current for power and lighting purposes. There are altogether about 200 exhibits, which include a considerable number of automobile exhibits, among these being two electric automobiles. A partial list of exhibits in the electrical and allied fields follow:

Anderson Carriage Company (electric vehicles); Knop Battery Company ("Wizard" house-lighting plant, igniters and battery chargers); Hovey & Falk (electric vehicles); Michigan Copper & Brass Company; Kerr Machinery & Supply Company (automatic electrically driven water systems); Palm Vacuum Cleaner Company (vacuum cleaner); Northern Engineering Works (cranes); Detroit Insulated Wire Company (wire-insulating machinery in operation); Edison Illuminating Company (current-using devices); Detroit Copper & Brass Rolling Mills (bare copper and brass wire, rods and tubing); Hoskins Manufacturing Company (electric furnaces, soldering irons and heating appliances); Detroit Twist Drill Company (drills and reamers); Wright Manufacturing Company; American Blower Company (Sirocco fans, ventilating furnace, cupola, forge and blower, engine-generator set); Austin Separator Company; Chicago Pneumatic Tool Company, Chicago; Osburn Electric Company (electric gas-stove lighter, spark coils, magnetos and ignition specialties); Eureka Vacuum Cleaner Company (portable vacuum cleaner).

SUPPLY MEN AT OSHKOSH CONVENTION.

At the Oshkosh convention of the Wisconsin Electrical Association, on June 28 and 29, no exhibits of apparatus were made, but the following-named representatives of electrical manufacturers and dealers were in attendance: Messrs. F. T. Andrae and J. C. Schmidtbauer, Julius Andrae & Sons Company, Milwaukee; Glen L. Johnson and Donald H. Wyre, Buckeye Electric Company, Chicago; A. W. Dunham, Central Electric Company, Chicago; P. R. Boole and J. B. McMullin, Electric Appliance Company, Chicago; M. L. Demming and T. W. Jackson, General Electric Company, Chicago; E. A. Quarfot, Illinois Electric Company, Chicago; E. F. Berger, Midvale Steel Company, Chicago; W. H. Talkes, Pittsburgh Meter Company, East Pittsburgh, Pa.; W. R. Patton, Wagner Electric Manufacturing Company, Chicago; O. O. Tucker, Western Electric Company, Madison, Wis.

Industrial and Commercial News

THE WEEK IN TRADE.

TRADE reports continue to show that business is very irregular, and in many sections unsatisfactory. Retailers are not disposing of the stocks with anything like the rapidity that was anticipated, and there is a general disposition in the direction of conservatism in almost all quarters. Weather conditions, while they have been somewhat improved, are as yet not thoroughly encouraging. In the Northwest there has been entirely too much dry weather, and in the central Gulf States there has been an excess of moisture. There is still considerable uncertainty felt as to the outcome of the spring wheat crop, and this has a deterring influence upon all classes of trade throughout the section of the country where spring wheat is the main production. Cotton has in a measure improved, especially in Texas. The iron and steel industries continue to be moderately active, but it is claimed that the mills are kept busy in many instances by making concessions in prices that will reduce profits. The production of pig iron is still in excess of the demand, and prices are inclined to be weak. The textile trade, which has not been in good shape for many months, shows no improvement. In both cotton and woolen goods there is general curtailment. Prices for manufactured products in these lines are gradually being lowered, and only the uncertainty as to the cost of raw material prevents material cuts. The unsettled condition of the securities market has had some effect upon commercial business. It has also had a decided effect in the matter of collections, and these are far from satisfactory. Failures for the week ended June 30, as reported by *Bradstreet,* were 197, as compared with 187 for the previous week; 213, for the same week in 1909; 236, in 1908; 135, in 1907, and 134 in 1906.

THE COPPER MARKET.

DURING the last few days of June there was quite an increase in the exports of copper, which if it did not have the effect of strengthening prices locally, at least had the effect of putting some heart in the discouraged traders in the copper market. The total exports for the month amounted to 22,688 tons or approximately 51,000,000 lb. It is not likely that the unexpected increase in exports will produce any very favorable results in the figures of the Copper Producers Association, for at the same time that exports were expanding imports were growing to an unprecedented figure. It now seems probable that the total receipts from abroad during the month will amount to about 18,000 tons, breaking all previous records. The domestic market during the week that preceded the holidays was extremely dull. But few sales were made to domestic consumers and practically all of these few were small lots to minor concerns which bought only from immediate necessity. Prices during the week were lower both at home and abroad and there were reports in the local market that offers were made even below the quoted scale. The condition of the copper trade in Europe shows no improvement. A London authority on the copper situation, who visited New York last week, says that no one knows the exact amount of surplus metal now carried in England and the Continent. The optimists, he says, are willing to admit that it will reach 140,000 tons and the pessimists declare that it will considerably exceed 200,000 tons. This authority also believes that the mines in Africa which are now being promoted and developed will soon turn out a large amount of copper which can be produced at something like seven cents a pound. One of the reports which was widely circulated in the market last week was to the effect that quite a number of representative American copper producers and sellers were now in London arranging a deal whereby the sale of about 100,000,000 lb. to foreign buyers would shortly be put through and the domestic situation thereby relieved. This may be a dream or it may be true, but it is difficult to understand how it will ultimately benefit the situation. As long as the mines of the world continue to produce every month 25 per cent more copper than the melters can use, prices can only be maintained by artificial methods. There can be no satisfactory market condition where production persistently exceeds demand. The daily call on the Metal Exchange July 2 quoted standard copper as per accompanying table.

Standard Copper.	Bid.	Asked.	Settling price.
Spot	11.87½	12.10	.....
July	11.90	12.05	11.97½
August	11.90	12.05	11.97½
September	11.90	12.05	11.97½
October	11.92½	12.10	12.00

The London market July 2 was as follows:

	Noon. £ s. d.	Close. £ s. d.
Standard copper, spot	54 15 0	54 11 3
Standard copper, futures	55 10 0	55 6 3

Extreme fluctuations for this year:

	Highest	Lowest.
Standard	13.50c	12.05c
London, spot	£62 0 0	£54 2 6
London, futures	65 18 9	54 17 6
Best selected	65 10 0	59 0 0

INDUSTRIAL AND COMMERCIAL NOTES.

Foreign Filaments in This Country.—Frank Greenhalgh, manager of the Electric Manufacturers' Agency Company, and representative in this country of the International Filaments Company, Ltd., and Stewart & Company, of London, says that the sale of foreign tungsten filaments in this country has been very satisfactory. The smaller lamp manufacturers all over the country have been purchasers, and more are buying as the filaments become better known. The special safety cartons in which the lamps are packed is also receiving recognition in this country. This carton, which is a patented article, is handled in the United Kingdom by Johns, Son & Watt, Ltd., London, and in this country by the Manufacturers' Agency Company, 1269 Broadway, New York. The carton not only protects the lamp from breakage, but it also permits the lamp to be lighted and tested before the seal of the package is broken. Mr. Greenhalgh says that the 45 per cent. duty makes the cartons more expensive than they should be, and that probably arrangements will be made to manufacture them in this country.

Westinghouse Business for Six Months.—The business of the Westinghouse Electric & Manufacturing Company for the first six months of 1910 has been the largest in the history of that corporation. May was an especially large month, and the plants of the company are reported as working at present at full capacity. One of the officials of the company says that orders taken during April and May amounted to $7,083,038, and that the unfilled orders on hand May 31 were approximately $13,000,000. Like the other electric manufacturing companies, the business done by Westinghouse has been largely in the line of small apparatus. Very little heavy machinery is being ordered, but there is a large quantity of business in a small way. Motors for traction companies have furnished no inconsiderable part of the business of the company.

Postal Company's Telephone Alliance.—It is announced in St. Louis that the Kinloch Telephone Company has formed a traffic alliance with the Postal Telegraph Company covering Illinois, Indiana, Iowa, Missouri, Kansas, Kentucky and Ohio. This alliance is similar to the Western Union-American Telephone & Telegraph traffic agreement. The Kinloch Telephone Company operates in St. Louis and East St. Louis, and is a subsidiary of the Kinloch Long Distance Telephone Company which operates in portions of all of the States above named. There will be no financial connection between the telephone company and the Postal Telegraph Company.

Edison Electric Illuminating Company of Brooklyn.—W. W. Freeman, general manager of the Edison Electric Illuminating Company, of Brooklyn, announces that he is formulating plans whereby the employees of the company will be invited to share in its profits. He states that these plans are still in embryo, and have not as yet been definitely decided upon. The company, he says, intends to adopt a new system, and it will probably take six months to get the ideas worked out in a practical shape. The plans will probably embrace some system for pensioning old employees.

Marseilles (Ill.) Hydraulic Company.—The Marseilles Hydraulic Company, of Ottawa, Ill., which was recently incorporated, has prepared plans for the construction of a hydroelectric plant on the south side of the Illinois River at Marseilles, where a lease for 99 years has been secured. Work upon this new plant will be commenced about Sept. 1.

Lower Prices for Rubber.—The excessively high prices for crude rubber which prevailed early in the spring have been to some extent modified. Para, which sold up to almost $3 per lb., is now selling at about $2.40; Centrals, which formely sold at $1.50, are now selling at about $1.30, and Africans, which were as high as $1.95, are now selling at about $1.60. In discussing the effect of the high price of crude rubber upon the insulated wire trade, one of the best-known rubber authorities in the United States said: "Of course, higher prices for rubber must make the cost of insulated wire higher. It is a mistake, however, to think that insulated wire manufacturers are restricted to the use of Para, or even the better grades of African, for their insulation. Many years ago it was the generally accepted theory that nothing but the best rubber could be used for insulated wire. That theory has been very largely modified. It was a long time before wire manufacturers could be induced to use any reclaimed rubber, but now it is found that this material can be very successfully employed in connection with high-grade rubbers for insulating purposes. Of course, I am speaking only of the honest manufacturers who use rubber insulation, and who do not use substitutes and pitch. Reclaimed rubbers, Guayule and other brands of cheaper rubber, are now used quite extensively, and very sucessfully. Of course, there is no rubber in the world that has the elasticity of 'Islands fine Para,' but elasticity is not such an important factor when it comes to insulation. As to the price of rubber, I am of the opinion that it will gradually decline until we reach a reasonable basis. I have recently made an extended trip up the Amazon, and I am persuaded that there need be no fear of a scarcity of rubber. There is plenty of rubber in that vast territory to supply all of the needs of the world for many years to come. The trouble has been heretofore that there was not sufficient labor, nor a sufficiently systematized method in rubber gathering. The business men of Manaos, however, have now taken up this problem, and I believe that in the future the forests of the upper Amazon will be worked so as to develop very much larger quantities of rubber than they have heretofore. Whether it will be possible to import foreign labor into that country or not I am not certain, but the people who have the matter now in hand are progressive, and will work out some solution to the problem. The rubber excitement in London has been purely speculative, and I see no reason why the craze to buy shares in rubber-growing companies should work a permanent advance in rubber itself. In fact, the London speculative mania has almost spent itself. I believe that next year will see the rubber market on a steady and legitimate basis, and that after that we will have few of these speculative excitements." The speculative nature of the present London rubber situation is confirmed by an English financial expert now in New York, who has made a study of rubber production. One result of the recent and present inflated situation is, he says, a tremendous stimulation in planting rubber-producing trees, thereby promising a great future overproduction.

Allis-Chalmers Business for the Half Year.—An official of the Allis-Chalmers Company says that the business for the first six months of 1910 has been the best the company has ever had in a similar period. "There was a gradual improvement," said he, "from the beginning of the year. Every month was better than the one preceding it, and every month was better than the corresponding month last year. The month of May was one of the largest the company has ever experienced. Sales during that month were at the rate of $25,000,000 per year. Only two months since the company began have exceeded the past May. Quite a large portion of our business has been for small apparatus, which in itself is an advantage to the company. This sort of business means early delivery and quick collections. It might also be said that there is a better profit in small apparatus than heavy stuff. Our factories are running full time, and we are employing quite a large force, but we are not running up to capacity. During the last few years we have added new buildings and increased our capacity quite materially, and we have not yet reached this new limit."

Telephones on Lehigh Valley Trains.—Portable telephones are soon to be installed on passenger trains of the Lehigh Valley Railroad, which will make it possible for the train crew or any passenger to get into communication with the rest of the world at any isolated point along the road. A series of experiments have recently been carried on, which, it is claimed, have demonstrated the practicability of such a service. By means of an extension pole, which can be hooked over the telephone wires running parallel to the track, it will be possible to make connection at any point. It is thought that this system will be especially valuable in presenting delays in freight service. The equipment for this service, as well as the telephone equipment for train dispatching, has been furnished by the Western Electric Company. The Lehigh road has been adopting telephones for dispatching for a number of years, and many of its branches are now equipped with this service. It is the intention of the officials to equip the entire line as soon as possible.

New Telephone Line in Arkansas.—Plans have been practically completed whereby 60 miles of telephone line will be placed in service along the St. Francis levee, in eastern Arkansas. The system will cost about $12,000, of which $6,000 will be paid by the L. C. Going Telephone Company, of Marion, Ark.; $3,000 by the land owners who will use the service, and $3,000 by the St. Francis Levee Board. The telephone line will extend from Marion to the south end of the levee. Wires are to be strung on cedar poles erected on top of the levee. The service will be inaugurated with 50 telephones at Marion, and connections will be made with the lines of the Southwestern Telephone & Telegraph Company, which has connections to all of the principal points in the United States.

Ft. Wayne Electric Works Adds New Factory.—The foundations have been completed for the new factory and office buildings to be erected by the Ft. Wayne Electric Works adjacent to its present plant on Broadway, Ft. Wayne, Ind. This improvement was described in our issue of March 17. The new four-story factory building, 229 x 140 ft., and 76 ft. high, will practically double the company's present manufacturing floor space. Its construction embodies some of the most approved features of factory building. Excellent interior daylight illumination will be afforded by about 500 windows. The new office building adjoining will be five stories high, and occupies a space 60 x 140 ft. Part of these structures will be ready for occupancy by September.

Long Island Railroad Company.—The Long Island Railroad Company has received 16 new steel motor cars on its order of 140, and expects to receive four per week during the summer. The tardiness of these deliveries is attributed to the long-continued strike in the shops of the Pressed Steel Car Company. Four hundred of these cars have been ordered, and they will be delivered as rapidly as completed. The East River tunnel of the Pennsylvania Railroad is ready to be put in operation. It is expected that the date for this opening will be in August, 1910, and that by that time the railroad will be fully equipped. The new steel cars contain the latest devices in the way of electrical heating and lighting, and will cost when completed about $20,000 per car.

Southern Railway Orders Gas Electric Cars.—The fact that the Southern Railway Company was experimenting with gas-electric cars for use in suburban traffic was referred to in the issue of June 9. It is now stated that the officials of the road are satisfied with the success of the experiments and that three cars have been ordered from the General Electric Company, which is building them in connection with the McKeen Motor Car Company, of Omaha. These cars will be used to supplement the steam train service in the congested district in the neighborhood of Greenville, S. C. While these cars are being built, the car belonging to the General Electric Company, which was used experimentally, will be put into service.

Big Four Mill Equipment.—The Maple Leaf Milling Company, Ltd., of Port Colbourne, Ontario, which possesses one of the largest and most complete flour mills in America, has just placed an order with the Allis-Chalmers-Bullock Company, of Montreal, for a complete outfit of machinery. The buildings are now being erected and the mill is expected to be in operation when the fall grain movement begins. The installation includes transformers of 2,400 kw capacity, with switchboards and a large number of individual motors. The contractors will turn the mill over ready to run.

To Place Wires Underground.—The Metropolitan Electric Company, Reading, Pa., will place its wires throughout the business section of the city underground. Plans and specifications are now being prepared by a corps of engineers engaged for this work. Legislation granting the company the required permission to do this will shortly be introduced in the city council. The conduits will carry the heavy feed wires from the new plant to a distributing station in the central portion of the city.

Increased Business in Flaming Arc Lamps.—There is a constantly increasing demand for flaming arc lamps, according to Theodore Stave, president of the Stave Electrical Company. Mr. Stave has but recently returned from a lengthy Western trip, and he says that he finds all over the country a growing interest in flaming arcs for the illumination of factories and public concourses. The Stave company has recently made quite a number of important installations, and has under negotiation several more. This company has supplied the equipment for the largest installation in the country, that of the Weston-Mott Company and the Buick Automobile Company, which are practically the same concern, at Flint, Mich. In this plant the Stave Company has placed about 900 lamps. The service has been entirely satisfactory, and a letter from the superintendent of the factory, recently received, says that the bill for repairs for the lamps for an entire year has been less than $15. Mr. Stave has also recently placed 26 lamps in the terminal station of the Central Railroad of New Jersey, at Jersey City. Of this number 20 are in the train shed, and the illumination furnished there has been pronounced thoroughly satisfactory by the officials of the road. Before the installation of these lamps the shed was lighted by 36 arcs and 75 incandescents. These furnished less than 20,000 cp, and cost for current about $5,500, while the new lights are guaranteed to furnish 60,000 cp, and not to cost more than $4,161 for the year. The new lamps consume about 11 kw per hour, while the old lamps consumed about 25 kw per hour. This installation shows, according to Mr. Stave, that three times as much illumination can be furnished at less cost by the use of flame arcs. The Stave company has within the past few months furnished the city of Cincinnati with 30 lamps for park lighting, and is now figuring on increasing this installation many fold. It has also furnished to business men's associations in Davenport, Iowa, and Perth Amboy, N. J., quite a number of lamps for street lighting. The municipalities are slow to take up the flaming arc, largely, as Mr. Stave thinks, because it requires a daily trim, but in many places the merchants have been willing to pay for the illumination of the business centers. The Stave lamp has recently been selected by the officers in charge of the government arsenal at Rock Island, Ill. This selection was made after long and exhaustive tests. The arsenal will eventually use between 300 and 400 lamps.

Pennsylvania Railroad and Steinway Tunnel.—Plans are being perfected by the Pennsylvania Railroad Company to make a connecting link between its terminal in Long Island City and the Steinway Tunnel under the East River, and to provide for a transfer station near the Hunter's Point Avenue viaduct. By this arrangement the Long Island Railroad will have direct communication with the subway system in Manhattan. The charter of the Pennsylvania Railroad prohibits its carrying local traffic through these tunnels between Manhattan and Long Island City, and the nearest station where passengers can board a Pennsylvania train for transportation through these tunnels is at Winfield, three miles outside of Long Island City. This transfer arrangement will give passengers from Long Island who prefer to use the New York Subway a chance to leave the trains of the Long Island Railroad and go to Manhattan through the Steinway Tunnel.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Stamford, Tex.; Foraker, Okla.; Danville, Ind.; Ansonia, Conn.; Reedville, Va.; England, Ark.; Salem, Mass.; Elkins, W. Va.; Indianapolis, Ind.; Crosby, Minn.; Strawberry Point, Ia.; Omaha, Neb.; Maricopa, Cal.; Farmington, Utah; Salem, Wash.; Vancouver, B. C., Can.; Worcester, Mass.; Creston, Ohio; West Falls, Wis.; La Crosse, Wis.; Anamosa, Ia.; Ephraim, Utah; Lakeview, Ore.; Marseilles, Ill., and Carrollton, Ill.

Central Colorado Power Company.—It is stated in Denver that negotiations have been practically completed whereby the Denver City Tramway Company will be supplied with energy from the Central Colorado Power Company. If this deal is consummated it is understood that rotary transformers will be installed by the power company. The tramway company is now enlarging its steam plant in Denver, at a cost of about $375,000, for the purpose of using it as an auxiliary when the deal with the Central Colorado Company goes through.

Northern California Power Company.—The Inskip plant of the Northern California Power Company, at Red Bluff, Cal., was placed in operation June 12. The plant has an output of 8000 hp, making the total development of the company 27,000 hp. Work has also been commenced on a new plant at Horseshoe Bend, on Battle Creek, three miles above its junction with the Sacramento River. At this plant the water is delivered under a 480-ft. head, and it is estimated that 20,000 hp can be developed.

Pittsfield (Mass.) Electric Company.—Work has been begun on the new plant of the Pittsfield Electric Company, at Silver Lake, Mass. The cost will be about $225,000. It is expected to have the plant ready for operation by October 1. The present plant in Pittsfield will eventually be abandoned. The Stone & Webster Corporation, of Boston, will have charge of the construction work.

Belknap (Utah) Power Company.—Work has been commenced by the Belknap Power Company on a new plant in Sevier County. It is estimated that the plant will develop about 9000 hp. A tunnel 1400 ft. in length is being driven through the neck of a horseshoe bend, which will save the construction of flumes and canals. The cost of this development is estimated at $32,000.

Southern Power Company Franchise.—The Board of Aldermen of Durham, N. C., has granted a 60-year franchise to the Southern Power Company to furnish light and power to Durham and West Durham. It is understood that the company will build a 10,000-hp auxiliary steam plant in Durham.

Financial.

THE WEEK IN WALL STREET.

MYSTIFIED by the course of the Wall Street market last week, the professional traders and old-time observers are offering diverse explanations and many contradictory prophecies for the future. No one seems to be able to explain exactly what is the matter with the securities market. Everyone agrees that it is so heavy that it sinks with its own weight. At the present moment, the anomalous condition is presented of severe declines in prices whenever the market shows activity and of firmness in tone whenever the market is stagnant and dull. During the few days that preceded the holiday there was a sharp fall of prices throughout almost the entire list. Railroad shares were especially weak, but many of the most active industrials also recorded heavy reductions. During these declines the market was active and several days the transactions amounted to more than a million shares. The story of the week can be told in the fact that almost one hundred issues made new low records for the year. The liquidation was continuous and insistent. There seemed to be oceans of stock for sale and few buyers ready to purchase. For several days subsequent to the first sharp break the course of the market was identical; heavy sales during the forenoon session, light trading from noon until about an hour

NEW YORK.

	June 27.	July 1.	Shares sold.		June 27.	July 1.	Shares sold.
All.-Ch.	8¾	8½*	700	Int.-Met., pfd.	50	51¾	30,750
All.-Ch., pfd.	31	30¼	1,100	Mackay Cos.	88	84½	1,100
Amal. Cop.	61¾	60⅝	291,850	Mackay C.,pf.	75*	73*	100
Am. D. T.	20½*	20½*	———	Man. Elev.	130*	125	1,102
Am. Loc.	41¼	40¼	6,300	Met. St. Ry.	15*	15*	———
Am. Loc.,pfd.	108	107*	400	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	75*	75*	———	Steel, com.	74¾	72⅛	1,060,000
Am. T. & T.	135	132½	11,630	Steel pfd.	115½	115½	19,020
B. R. T.	76	74¼	62,360	W. U. T.	63½	62¾	1,200
Gen. Elec.	143	141	3,800	West'h., com.	62	61	4,800
Int.-Met.	18	17¾	23,450	West'h., pfd.	123*	115*	100

PHILADELPHIA.

	June 27.	July 1.		June 27.	July 1.
Am. Rys.	44	43*	Phila. Elec.	14¾	14¾
Elec Co. of A.	11⅝	11⅜	Phila. R. T.	19	18½
Elec. St. B'ty	53	49	Phila. Trac.	84½*	84½*
E. S. B'ty, pfd.	30*	30*	Union Trac.	46½	45

CHICAGO.

	June 27.	July 1.		June 27.	July 1.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	118⅛	117*
Chi. Rs., Ser. 1	75*	75*	Met. El., com.	24*	22*
Chi. Rs., Ser. 2	18	16½	Met. El., pfd.	69	70*
Com. Edison	114	112	Nat'l Carbon	116	120
Chi. Subways	2½	2⅜	Nat'l Car., pfd.	118	118*

BOSTON.

	June 27.	July 1.		June 27.	July 1.
Am. T. & T.	135	132½	Mex. Tel.	6	5½*
Cum. Tel.	142*	142*	Mex. Tel., pfd.	6½	6½*
Edison E., Ill.	250	252	N. E. Tel.	132*	133¼
Gen. Elec.	145	140	W. T. & T.	15¼*	15¼*
Mass. E. Ry.	16	14¾	W. T. & T., pfd.	87*	87*
Mass. E. Ry., pfd.	80	76			

* Last price quoted.
Shares sold for four days, June 27 to July 1.

before the close, then a few purchasing orders which were sufficient as a rule to partially recover the morning's losses. For the most part, however, each of these days recorded a net loss on every active issue. There was very little substantial support offered by those heavy financial interests which have for several years been back of the upward movement. It is the general opinion in the street that this market condition is not to be explained by the recent railroad legislation or by any other decided influence. This opinion has brought about a condition in Wall Street where only the reckless trader is willing to hazard an opinion as to the future, or to make for himself any heavy investment on either side of the market. One feature that makes the market past the understanding of financial experts is the fact that scores of good dividend-paying stocks are selling at figures which would net the invester from 5 per cent to 7 per cent, while the banks are filled with money that can be borrowed at less than 4 per cent. Such a situation can only be possible through an utter lack of confidence as to the future earning capacity of railroads and industrials. The money market during all this turmoil has continued to be easy and rates are cheap. Rates July 1, the last day the financial markets transacted business before the holiday, were: Call, 2½@3¼; 90 days 4 per cent. The quotations in the table are those of the close July 1.

Financial Notes.

Red River Power Company.—H. M. Byllesby & Company, of Chicago, have purchased the property of the Grand Forks Gas & Electric Company, which operates in Grand Forks, N. D., and East Grand Forks, Minn. The electric property at Red Lake Falls, Minnesota, and certain other smaller properties, were acquired, also. All were formerly owned by Minneapolis interests, headed by W. J. Murphy, publisher of the Minneapolis *Tribune*. A new company, which will operate the properties acquired in and near Grand Forks, has been organized. It is called the Red River Power Company. Thomas Roycraft has been retained as local manager. The Red River Power Company proposes at once to make extensive additions and improvements to the gas and electric systems at Grand Forks and East Grand Forks, including the extension of many miles of distributing mains and transmission lines into sections not now served.

International Traction Company.— Another bondholders' committee has been formed in an effort to straighten out the affairs of the International Traction Company, of Buffalo. The committee referred to in our last week's issue represents the majority of the 5 per cent collateral trust bonds, but the new committee, it is said, will also have a number of bonds deposited with it. The members of this second committee are: Hardin H. Littell and George R. Teller, of Buffalo, and John W. Green, of Louisville. In the announcement of this new committee it is stated that the terms of the reorganization as proposed by the first committee, of which Robert L. Fryer is chairman, will work to the prejudice of the bondholders and in favor of the stockholders. Mr. Littell was formerly actively connected with traction enterprises in Buffalo.

United Railways of Baltimore.—The United Railways & Electric Company of Baltimore have made an increase of about $40,000 in May over the earnings of the same month last year, or a percentage increase of 6 per cent. From the record of earnings which the United is now earning it is practically certain that it will close the first half of 1910 with an increase in net earnings of not less than $200,000, and it is probable that an even better showing will be made provided June revenues meet expectations. The company is also planning to extend the Washington street line to Orangeville, Md., and the right of way is now being procured. It is expected that this extension will be a profitable source of revenue to the company.

Cambridge Electric Light Company.—The Board of Gas & Electric Light Commissioners of Massachusetts has approved the issue of $50,000 additional stock by the Cambridge Electric Light Company. The stock is to be offered at $200 per share. The proceeds of the new issue are to be used for making additions to the plant.

Interstate Light & Power Company.—H. M. Byllesby & Company of Chicago have purchased the generating and distributing properties owned by the Interstate Light & Power Company with headquarters at Galena, Ill. This company serves a territory of 200 square miles in area in the lead and zinc mining fields of southwestern Wisconsin and northwestern Illinois. Power is produced at a modern steam generating station near Galena recently completed. All the energy used in Galena, Ill., and Platteville, Cuba City, Benton and Hazel Green, Wis., is supplied by the Interstate company. These cities and towns comprise a population of 18,000. Power business received from the lead and zinc mines has created a large day load. Byllesby & Company propose to make additions and improvements.

New York Air Brake Company.—At a special meeting of the directors of the New York Air Brake Company, last week, a quarterly dividend of 1½ per cent was declared on the stock. This is the first dividend which the company has declared since October, 1907. Prior to that time, for quite a number of years, the company had been declaring 8 per cent dividends. It was given out after the meeting that, while the operations of the company were hardly up to the level which obtained prior to 1907, the output has been large enough to warrant the resumption of dividends. The company has $10,000,000 of capital stock outstanding, and $3,000,000 of 6 per cent bonds.

Berkshire Street Railway Purchase Approved.—The Massachusetts Railroad Commission has approved the purchase of 1923 shares of the Berkshire Street Railway Company, of Pittsfield, Mass., by the New York, New Haven & Hartford Railroad Company. The railroad company pays $149.90 per share for the stock. This purchase was recently authorized by special enactment of the Legislature. This purchase gives the New Haven railroad control of the entire traction system in the Pittsfield district, the Pittsfield Electric Street Railway Company having been taken over last February.

Consolidation in Colorado.—As has been anticipated for some time the Colorado Springs Electric Company, Colorado Springs Light & Power Company and Pike's Peak Hydroelectric Company have been merged into the Colorado Springs Light, Heat & Power Company, with a capitalization of $2,000,000. Greater efficiency in service and economy in administration are the principal reasons for the consolidation. George Bullock, the president, and George B. Tripp, the general manager of the three companies, will be re-elected to the same positions.

Norfolk & Portsmouth Traction Company.—The stockholders of the Norfolk & Portsmouth Traction Company voted last week to change the capitalization of the company from $6,000,000 common stock, to $3,000,000 common and $3,000,000 5 per cent cumulative preferred. Each holder of two shares of the old common stock will receive one share of the new common stock, and the privilege of subscribing to one share of the preferred at $60, par being $100. It is estimated that the new plan will bring to the company about $1,800,000 new capital.

Federal Light & Traction Company.—The Federal Light & Traction Company, which was recently incorporated under the laws of New York, has filed a certificate with the Secretary of State increasing its capitalization from $2,000 to $11,000,000. This company was referred to in the issue of June 9. It embraces properties controlled by Sanderson & Porter, Harrison Williams, J. B. Colgate and certain financiers identified with the National City Bank. The properties are located in the far Northwest, and in the Southwest.

Northern Indiana Gas & Electric Company.—It is stated in Philadelphia that the United Gas Improvement Company has acquired a majority of the stock in the Northern Indiana Gas & Electric Company, which company recently took over the property of the South Bend & Mishawaka Gas Company and of the Plymouth Lighting Company. This company, of which C. H. Geist is president, also controls the other properties in which Mr. Geist is interested in northern Indiana.

Hornell & Bath Interurban Railway Company.—The Public Service Commission of the Second District of New York has authorized the Hornell & Bath Interurban Railway Company to issue $195,000 of bonds. The proceeds of this issue are to be used for the construction of the company's line from Hornell to Bath. This issue is in addition to the previous issue which was authorized, amounting to $450,000 of bonds.

Greenville-Carolina Power Company.—The plant of the Greenville-Carolina Power Company, of Greenville, S. C., which was recently purchased by the Southern Power Company, will be greatly enlarged and equipped with modern machinery. The price paid for this property was about $250,000. The company is capitalized at $200,000, and has $300,000 in bonds.

Commonwealth Power Company.—John C. Weadock, of New York City, attorney for the Commonwealth Power Company, the holding corporation for the public utility properties owned by Hodenpyl, Walbridge & Company, and E. W. Clark & Company, in Michigan and Wisconsin, says that the merger is operative at the present time, and that the business is being conducted under the holding corporation. The Commonwealth Power Company holds the stock of the Michigan Gas Company, which controls the gas properties; it also holds the stock of the Consumers' Power Company, which controls the electric light properties, and the stock of the railway companies. Owing to the objection of the Michigan Railroad Commission, the Commonwealth Power Company has issued no bonds, but the needs of the underlying companies are being provided for by separate bond issues, each company taking care of its own affairs. Mr. Weadock says that the earnings of all of these properties have increased and are now entirely satisfactory.

Denver Irrigation and Reservoir Company.—The receiver recently appointed for the Denver Irrigation & Reservoir Company has been granted authority by the United States Court, at Denver, to issue receiver's certificates amounting to $650,000. This amount, it is thought, will be sufficient for the completion of the Standly dam, and the establishment of an irrigation system that will reclaim 250,000 acres of land. A representative of the Trowbridge & Niver Company, of Chicago, which firm undertook to finance the proposition, says that the issuance of these certificates will relieve the company of all present embarrassment. This is the concern which Henry L. Doherty recently undertook to carry through after the failure of the financiers to place the securities. Mr. Doherty will remain in control of the company.

Montgomery, Ala., Lighting Muddle.—Contempt proceedings were begun June 30 in the Federal Court at Montgomery, Ala., against Alex. Rice, formerly president of the Citizens Light and Power Company, and F. S. Ball, his attorney. The accusation is that the defendants violated an injunction, procured by Henry L. Doherty, prohibiting them from selling their stock in the Citizens company, Doherty claiming that the stock had been already sold to him. It is claimed that after the injunction was issued Rice and Ball sold their shares to Richard Tillis. Mr. Rice was on the stand throughout the day and testified that when he sold to Tillis on June 16 he had not been notified that an injunction had been issued. He explained that the transaction with Tillis was completed outside of Montgomery and that he was not in Montgomery until late in the afternoon June 16 subsequent to the deal with Tillis. The hearing has not yet been completed.

Funds for Chicago Subway Development.—The Supreme Court of Illinois has rendered a decision holding that the money which the City of Chicago has received from the traction companies as its share of the net receipts, under the present law, can be used by the city for the construction of a subway system. This fund now amounts to over $4,000,000.

Birmingham Railway, Light & Power Company.—Both the gross and net earnings of the Birmingham (Ala.) Railway, Light & Power Company for May show large increases over last year. In fact, the company has shown a very substantial growth in earnings since the beginning of the year. The increase in gross for the five months ending May 31 amounted to $151,133, or 16.42 per cent; and the increase in net was $79,715, or 23.01 per cent.

Pennsylvania Gas and Electric Merger.—Emmet Quinn, a Pittsburg capitalist, has purchased the Harrisburg Heat, Light & Power Company and the Paxtang Electric Company, of Harrisburg. The price paid for these two properties is said to be about $3,000,000. The companies are to be consolidated with the Citizens' Heat, Light & Power Company, of Johnstown. It is said that negotiations are now being conducted for the purchase of a number of other gas and electric plants in Pennsylvania, which are to be included in this merger.

DIVIDENDS.

American Gas & Electric Company, quarterly, 1 per cent, payable July 12.

Bell Telephone Company of Pennsylvania, quarterly, 1½ per cent, payable July 15.

Boston & Northern Street Railway Company, common, 2 per cent, payable June 30; preferred, semi-annual, 3 per cent, payable Aug. 1.

Boston Suburban Electric Companies, preferred, quarterly, 1 per cent, payable July 15.

Chicago Pneumatic Tool Company, quarterly, 1 per cent, payable July 15.

Colorado Telephone Company, quarterly, 1¾ per cent, payable July 15.

Columbus (Ohio) Gas & Fuel Company, 1 per cent, payable Aug. 1.

Electric Utilities Corporation, preferred, semi-annual, 2½ per cent, payable July 1.

Fonda, Johnstown & Gloversville Railway Company, 2 per cent, payable July 20.

Fort Smith (Ark.) Light & Traction Company, preferred, quarterly, 1½ per cent, payable July 15.

New York Air Brake Company, quarterly, 1½ per cent, payable July 29.

North States Power Company, quarterly, preferred, 1¾ per cent, payable July 15.

Oklahoma Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable July 15.

Old Colony Street Railway Company, common, 3 per cent, payable July 15; preferred, semi-annual, 3 per cent, payable Aug. 1.

Ottumwa (Iowa) Railway & Light Company, quarterly, preferred, 1¾ per cent, payable July 15.

San Diego (Cal.) Consolidated Gas & Electric Company, quarterly, 1¾ per cent, payable July 15.

Southern New England Telephone Company, quarterly, 1¼ per cent, payable July 15.

Standard Underground Cable Company, quarterly, 3 per cent, payable July 11.

United Metals Selling Company, quarterly, 5 per cent, payable July 15.

United States Light & Heat Company, preferred, semi-annual, 3½ per cent, payable July 15.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Baton Rouge (La.) Electric Company:					
April, 1910	$8,302	$5,162	$3,140	$1,959	$1,181
April, 1909	7,343	6,053	1,290	661	629
Cape Breton Electric Company, Ltd.:					
April, 1910	20,729	11,659	9,070	5,050	4,020
April, 1909	16,511	11,209	5,302	5,056	246
Columbus (Ga.) Electric Company:					
April, 1910	40,695	15,943	24,752	19,981	4,771
April, 1909	29,778	15,478	14,300	12,862	1,438
Detroit United Railroad Company:					
May, 1910	795,380	476,300	319,080	163,368	167,908
May, 1909	664,507	389,179	275,328	154,932	133,065
Lake Shore Electric Company:					
May, 1910	100,424	52,983	47,441	35,035	12,405
May, 1909	89,534	47,111	42,423	34,581	7,842
Northern Ohio Traction & Light Company:					
May, 1910	207,323	111,250	96,073	43,375	52,698
May, 1909	188,749	103,832	84,917	43,809	41,107
Paducah (Ky.) Traction & Light Company:					
April, 1910	20,383	12,342	8,046	7,047	999
April, 1909	18,351	11,136	7,215	7,034	181
Rio Janiero Tramway, Light & Power Company:					
May, 1910	916,476	466,125	450,351	.....	.....
May, 1909	646,108	391,736	254,382	.....	.....
Sao Paulo Tramway, Light & Power Company:					
May, 1910	237,698	87,245	150,453	.....	.....
May, 1909	190,277	75,570	114,707	.....	.....
Tampa (Fla.) Electric Company:					
April, 1910	48,362	31,209	17,153	4,590	12,563
April, 1909	46,431	28,634	17,797	4,797	13,000
Twin City Rapid Transit Company:					
May, 1910	627,945	289,381	338,564	.....	.....
May, 1909	569,217	260,970	308,247	.....	.....

General News

Construction News.

ANNISTON, ALA.—The City Council has awarded the contract for lighting the streets of the city to the Anniston Electric & Gas Company for a period of 10 years. Under the terms of the contract the city is to have the privilege to purchase the plant at every five-year period.

ENGLAND, ARK.—The Richwoods Gin Company is reported to be contemplating the installation of an electric light plant and water-works system. The capital stock of the company has been increased from $10,000 to $25,000.

MARION, ARK.—Plans are being considered for the erection of a telephone line beginning at Marion and extending to the end of the St. Francis levee, 200 miles in length, at a cost of $12,000. It is proposed to connect it with the system of the Cumberland Telephone & Telegraph Company, at Memphis, Tenn. President Going of the Going Telephone Company is reported to be interested in the project.

MONTENE, ARK.—The Clubhouse, Hotel & Cottage Company is reported to be preparing plans for the installation of an electric light plant. It is understood that contract for construction of the plant has been awarded.

OLA, ARK.—The City Council is considering the question of the installation of an electric light plant to be owned by the municipality or operated under a franchise granted by the city. M. L. Martin is Mayor.

ALAMEDA, CAL.—Negotiations are under way between the property owners and the electric light commission of the City Council for erecting street electroliers in the residence districts on San Antonio Avenue and Horton Street, Alameda.

LOS ANGELES, CAL.—The lighting system in Central Park will be improved by the installation of ornamental electroliers, of which 72 will be erected.

LOS ANGELES, CAL.—Failure on the part of the electric companies to submit bids for supplying electricity for the ornamental lamps on West Pico Street, may compel the property owners on that thoroughfare to install meters on every post in order to secure electric lighting service. The post-meter plan has been suggested as a solution, because the companies can then be compelled to supply electricity.

MARICOPA, CAL.—Preparations are being made to enlarge the plant of the West Side Electric Company, of Maricopa, for the purpose of extending its system to adjacent oil fields and also to the towns of Taft and Moron. The plant will furnish a 24-hour service covering a territory of about 10 miles square. H. G. Shippe is president and general manager of the company.

MONTEREY, CAL.—Preliminary plans have been completed by the Monterey & Del Monto Heights Electric Railway Company for the construction of an electric railway to connect Monterey and Del Monte Heights, 4 miles in length. F. M. Fairchild, 1707½ Oak Street, San Francisco, Cal., is general manager.

NOVATO, CAL.—Bids will be received by the Board of Supervisors of Marin County for the sale of a franchise to erect transmission lines along the public streets and public highways of the Township of Novato, Cal., for which application has been made to the board by J. W. Cain.

OAKLAND, CAL.—The City Council has granted the Southern Pacific Railroad Company permission to equip its Webster Street-Alameda mole line for electrical operation. The grant provides for the lighting of the thoroughfare in a manner similar to the lamps to be installed by the company on its new line from Fourteenth Street to the bay.

RED BLUFF, CAL.—The Inskip power plant of the Northern California Power Company was placed in operation June 12 for the first time. The plant has an output of 8000 hp, making the total electrical output of the company 27,000 hp. The company has commenced work on the construction of another power plant in the Horseshoe Bend, of Battle Creek, at the Coleman place, three miles from the junction of the creek with the Sacramento River. At Coleman the water will be used for the fourth time; the water will be delivered under 480-ft. head, and it is estimated that 20,000 hp can be developed. Electricity from the Inskip plant will be transmitted to Chico. A second transmission line will be erected from Inskip by the way of the Coleman power plant to Hamilton City and thence to Chico.

SAN FRANCISCO, CAL.—It is reported that negotiations are under way by the United Railways Investment Company by which it will secure control of the Sierra & San Francisco Power Company. The new company, it is said, will own and control about 78,000 hp.

SEBASTOPOL, CAL.—The Board of Trustees has passed an ordinance granting a franchise for the erection and operation of electric transmission lines and telegraph and telephone lines on certain streets and highways in Sebastopol to John E. Bennett, the highest bidder.

DENVER, COL.—Negotiations are reported to be under way between the Denver City Tramway Company and the Central Colorado Power Company, by which the last named company will supply electricity to operate the street car system in this city. If the deal is consummated, it is understood that rotary transformers will be installed. The tramway company is now enlarging its Platte Street power plant, at a cost of about $375,000, which will be used as an auxiliary plant in case the deal goes through.

ANSONIA, CONN.—The Ansonia O. & C. Company, of Ansonia, Conn., manufacturers of corsets, shoes and suspender webbing, has commenced work on the erection of a new generator plant.

BRIDGEPORT, CONN.—A franchise has been granted to the Bridgeport & Danbury Electric Railway Company by the Supreme Court to construct an electric railway between Bridgeport and Danbury. The proposed railway is to operate from the terminus of the present North Main Street line of the Connecticut Company in Bridgeport through Trumbull, and over the Newton Turnpike through Stepney, Monroe, Botsford, Hattertown, Newton, Dodgingtown, and thence to connect with the system of the Danbury & Bethel Street Railway Company, which owns and will operate the new railway.

MIDDLETOWN, CONN.—The Middletown Electric Light Company has decided to supply alternating current from its new plant at the foot of College Street when completed. At present it is furnishing direct current, which will necessitate a change of motors. The company has submitted two propositions to its patrons using electricity for motors: One to furnish them with second-hand alternating-current motors to replace the motors now in use and the other to pay for half of the expense of installing new motors. The change will not be made until next fall.

NORWICH, CONN.—Preliminary arrangements have been completed by the Norwich, Colchester & Hartford Traction Company for the construction of its proposed electric railway. Construction on the Hartford end of the line will commence in about a month. It is expected to have 10 miles completed before the winter sets in.

WILMINGTON, DEL.—Negotiations have been consummated whereby the Philadelphia & Wilmington Traction Company, recently incorporated with a capital stock of $6,500,000, will be the holding company for all of the Interstate Railways Company's properties south of Philadelphia, which, it is stated, have been merged with the Wilmington Light & Power Company. The properties have all been acquired by leases of 999 years. O. T. Crosby, of New York, N. Y., will be president.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for furnishing and installing lighting fixtures in the United States buildings at Boulder, Col.; Clarinda, Ia.; Fayetteville, Ark.; Kearney, Neb.; Logan, Utah.; Marion, Ohio; Mayfield, Ky.; Pittsburg, Kan.; Shenandoah, Ia., and Newark, N. J., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

COLUMBUS, GA.—The contract for the construction of the Meritas Mills has been awarded to T. C. Thompson & Brother, of Birmingham, Ala., and Charlotte, N. C., including the erection of mill building, weave shed, power house, seven warehouses and village. The equipment will include 10,000 spindles and 170 looms, which will be equipped for electrical operation. Alvin Hunsicker, 320 Broadway, New York, N. Y., is president of the company; Fred S. Hinds, 19 Milk Street, Boston, Mass., is architect and engineer in charge.

FAIRBURN, GA.—The Fairburn & Atlanta Railway & Electric Company, which is constructing an electric interurban railway between Atlanta and Fairburn, a distance of 20 miles, is said to be contemplating using the Edison storage battery system to operate its cars. W. T. Roberts, of Fairburn, Ga., is president of the company.

IDAHO FALLS, IDAHO.—The City Council has awarded contracts for construction of a hydroelectric power plant in connection with the municipal electric plant as follows: For construction work to the Chatfield-Cutler Construction Company, of Salt Lake City, Utah, at $63,500, and for equipment and machinery to the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., for $28,288. Work on construction of the plant will commence at once.

LEWISTON, IDAHO.—Surveys are being made by the Lewiston-Clarkston Improvement Company on the Grand Ronde River in connection with the construction of a large power plant. The company has acquired a location for power site and all necessary holdings for same. The present power plants of the company are unable to meet the increasing demands for electrical service.

SWEETWATER, IDAHO.—Preparations are being made by the Webb Ridge Telephone Company, recently incorporated, for the construction of a rural telephone from Sweetwater into the Craig Mountain country, 25 miles in length, work on which will commence at once. J. A. Ferris is reported to be interested in the project.

CARROLLTON, ILL.—It is reported that the Harman Engineering Company, of Peoria, Ill., is receiving estimates on two centrifugal pumps driven by steam engines, two return tubular boilers, a small vertical boiler, feed water heater and an electric lighting unit for a drainage plant at Carrollton, Ill.

KEWANEE, ILL.—The City Council has rejected the ordinance providing for a new 30-year franchise for the Kewanee Light & Power Company.

MARSEILLES, ILL.—The Marseilles Hydraulic Company, of Ottawa, Ill., recently incorporated, is reported to be contemplating the construction of a hydroelectric power plant on the south side of the Illinois River at Marseilles, where it has secured a 99-year lease. It is understood that work on construction of the plant will begin about Sept. 1. Duncan McDougal is president of the company.

MONMOUTH, ILL.—The question of substituting electric motors for steam power for operating the pumps in the water works system in Monmouth, Ill., is under consideration. Electricity for operating the pumps will be secured from the plant of the Monmouth Public Service Company.

DANVILLE, IND.—Plans are being made by the Danville Light, Heat & Power Company for extending its service to the towns of Coatsville, Clayton, Mooresville and other towns to furnish electricity for street and commercial lighting and also to furnish electrical service to farmers along the line. The company now supplies energy in Danville, Plainfield and Brownsburg and farmers along its lines between those cities. James F. Lynch, manager of the Danville company has secured a franchise to construct and operate an electric light and power plant in Shoals, work on which will commence in the near future.

ELKHART, IND.—The Home Telephone Company is asking for a new franchise under the terms of which it promises extensive improvements and extensions of its lines in the country districts.

EVANSVILLE, IND.—The Schroeder Headlight Company, of Evansville, Ind., is reported to be considering the installation of a 75-kw direct-current generator.

FORT WAYNE, IND.—The Commissioners of Allen County have granted the Fort Wayne & Winona Traction Company a franchise to construct an electric railway through the county, with the provision that it complete the railway projected by J. A. Barry and associates by January, 1912.

FOWLER, IND.—The date of the sale of the property of the Fowler Utilities Company has been extended from July 2 to Oct. 15 at the request of the bondholders. The bondholders represented to the court that they did not learn of the approaching sale until a few days ago and that they had been unable to perfect an organization to buy in the plant in case there should be no other bidders.

GREENFIELD, IND.—The City Council has amended the electric light ordinance fixing a minimum charge of 65 cents a month, with a meter rate of 12 cents per kw-hour.

HAMMOND, IND.—The City Council has granted the Indiana Northwestern Traction Company a 50-year franchise to construct a railway in Hammond. The proposed railway will connect Cedar Lake, Hammond, Crown Point and Chicago. Eugene Purtelle, 222 La Salle Street, Chicago, Ill., is president.

HANOVER, IND.—Work has commenced on the construction of the proposed Cincinnati, Madison and Louisville electric railway of the Southern Indiana Traction Company. The power house at Scottsburg is being enlarged.

INDIANAPOLIS, IND.—Bids will be received by the Commission of the Indiana State School for the Deaf, Room 54, State House, Indianapolis, Ind., until July 13 for material and labor for a number of improvements, including the erection of an outside lighting system at the institution, located at the corner of the Monon Railroad and Forty-second Street, Indianapolis, Ind.

MUNCIE, IND.—The Muncie Heat, Light & Power Company has filed a certificate with the Secretary of State showing an increase in its capital stock from $30,000 to $500,000 and an authorization of preferred stock to the amount of $35,000. James C. Markley is president.

ANAMOSA, IA.—The installation of a new Corliss engine, generator, transformers, etc., is reported to be under consideration by the Anamosa-Oxford Junction Light & Railway Company.

CALMAR, IA.—It is reported that an election will be held July 7 to vote on the question of granting a franchise to C. Miller & Sons, of Clermont, Ia., to construct and operate an electric light plant.

FAIRPORT, IA.—Sealed proposals will be received by the Commissioner of Fisheries, Department of Commerce and Labor, Washington, D. C., until July 26 for construction of boiler and pump house for the biological station on government reservation at Fairport, Ia.

NEWTON, IA.—It is reported that the Newton & Northwestern Railroad will be equipped for electrical operation from Newton to Colfax. The railroad is owned and controlled by the Fort Dodge, Des Moines & Southern Railroad Company, of Fort Dodge.

OSSIAN, IA.—C. Miller & Son, of Clermont, Ia., is reported to have been granted a franchise to construct and operate an electric light and power plant in Ossian.

STRAWBERRY POINT, IA.—Bids will be received by the Town of Strawberry Point, Ia., until July 19 for a 90-hp gas producer and engine, a 50-kw, three-wire generator, pole line, wiring and brick building. A. R. Cole is town clerk. Oscar Claussen, German-American Bank Building, St. Paul, Minn., is consulting engineer.

ISLAND, KY.—Contracts have been awarded to the Charleston Electrical Supply Company, of Charleston, W. Va., by the Memphis Mining Company, of Memphis, Tenn., for equipment for its power plant at Island, Ky., including an engine built by the Ridgway Dynamo & Engine Company, of Ridgway, Pa., connected to a 300-kw direct-current generator, with switchboard and auxiliary apparatus. The plant will furnish electricity for operating the machinery in the mines, for hauling, surface work and for lamps.

McHENRY, KY.—The Farmers' Mutual Telephone Company is reported to be making arrangements to construct a telephone line to Beaver Dam, Ky.

SERGENT, KY.—Preparations are being made by the Letcher County Home Telephone Company for the construction of a telephone line to connect Whitesburg, Mayking, Sergent and Baker, Ky., a distance of 25 miles. It is understood that bids for construction of the line will be asked at once. W. B. Webb, of Colly, Ky., is manager.

WATERLOO, KAN.—It is reported that work has commenced on the construction of the power house of the Waterloo, Cedar Falls & Northern Railway. The plant will have an output of about 8000 kw and will cost $300,000.

WHITESBURG, KY.—The construction of an electric light system in Whitesburg is under consideration. Jesse L. Cannon, of the Whitesburg Telephone Company, is reported to be interested in the project.

CATAHOULA PARISH, LA.—The Southern Telephone Company, of Stamps, Ark., is reported to be contemplating extensive improvements to the telephone system in Catahoula Parish, Ia., which will involve an expenditure of about $150,000.

BALTIMORE, MD.—It is reported that the Baltimore & Pennsylvania Railway Company will soon commence work on the construction of its proposed electric railway along the Reistertown and Hanover Turnpike. The proposed road will connect with the Emery Grove line of the United Railways and with the Hanover and York systems at their intersection above Melrose. The cost of the road is estimated at $600.000.

BOSTON, MASS.—The State Board of Gas and Electric Light Commissioners has instructed the Charlestown Gas & Electric Company to reduce its price for gas from 90 cents to not more than 85 cents per 1000 cu. ft., the new rate to take effect not later than Aug. 1.

CAMBRIDGE, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Cambridge Electric Light Company permission to issue 500 shares of additional capital stock at $200 per share, the proceeds to be used for extensions to plant.

LOWELL, MASS.—The Wamesit Power Company is contemplating building an addition to its power plant on Lawrence Street, Lowell.

MILLBURY, MASS.—Announcement has been made by the Millbury Electric Light Company that the rate for electricity for lamps will be reduced from 20 cents to 19 cents per kw-hour, with a minimum charge of $1 per month. Free lamp renewals will be given in all cases, in accordance to the lamp rules issued July 1. T. R. Robinson, of Uxbridge, Mass., is superintendent.

PITTSFIELD, MASS.—The State Railroad Commissioners has approved of the purchase of the controlling interest of the Berkshire Street Railway Company, of Pittsfield, Mass., by the New York, New Haven & Hartford Railroad Company.

PITTSFIELD, MASS.—Work has commenced on the construction of the new plant of the Pittsfield Electric Company at Silver Lake, to cost about $225,000. It is expected to have the plant completed by Oct. 1. The present power plant on Renne Avenue will eventually be abandoned. The Stone & Webster Corporation, of Boston, Mass., has the contract for the work.

SALEM, MASS.—The Salem Electric Light Company has awarded the contract for extensive improvements to its power plant on Peabody Street to J. N. and V. S. Peterson.

UPTON, MASS.—Announcement has been made by the Upton Electric Light Company of a reduction in the price of electricity for lamps from 20 cents to 19 cents per kw-hour, the new rate to take effect from Aug. 1.

WORCESTER, MASS.—Plans have been completed by the Worcester Consolidated Street Railway Company for the construction of a new power station at Millbury. It is proposed to build an extension to the present plant in Millbury, on the Blackstone River, increasing the present output from 3000 hp to 5000 hp, which will be transmitted to Worcester. It is expected that plans will be carried out as soon as permission is obtained from the New York, New Haven & Hartford Railroad to erect high-tension transmission lines along its right-of-way from Millbury to Worcester.

IRON MOUNTAIN, MICH.—It is reported that the property of the Iron Mountain Electric Light & Power Company has been sold to a new corporation, which, it is said, proposes to develop what is known as Twin Falls, on the Menominee River, at a cost of about $800,000.

IRONWOOD, MICH.—The City Council has awarded the Ashland Power Company a franchise for an electric light, heat and power plant in Ironwood, Mich. A franchise was also granted to the company to construct an electric railway from Ironwood to Bessemer. A street lighting contract was also awarded to the company.

CROSBY, MINN.—A franchise has been granted to H. F. Pearce and associates for the construction and operation of an electric plant and water-works in Crosby. It is understood that work will commence on the building of the plants at once. The plant will furnish electricity in the towns of Deerwood and Cuyana, Minn.

DELANO, MINN.—It is reported that George Florida is contemplating the installation of a dynamo at the Rockford dam to supply electricity for lamps in Delano.

FORT SNELLING, MINN.—The contract for remodeling the electric light system at Fort Snelling, Minn., has been awarded to W. I. Gray & Company, of Minneapolis, Minn.

GRANITE FALLS, MINN.—At an election to be held July 12 the proposition to issue $40,000 in bonds, the proceeds to be used for the construction of an electric light plant, water power plant and water works system, will be submitted to the people.

RED LAKE, MINN.—Dr. N. J. Pinault, of New Orleans, La., is reported to be considering making improvements to the Healy water power owned by him.

NIXON, MO.—H. M. Wilson, of Nixon, Mo., is interested in a project to construct an electric railway from Nixon to Springfield. The land owners agree to give the right of way provided the railway is built and in operation by Jan. 1, 1912. W. H. Schrieber is engineer.

LINCOLN, NEB.—The capital stock of the Lincoln Telephone & Telegraph Company has been increased to $2,500,000.

OMAHA, NEB.—Extensive improvements and additions costing approximately $1,000,000 are contemplated by the Omaha Electric Light & Power Company, of which $350,000 will be expended this year. The immediate work will include the installation of new condensing machinery, a turbine engine and the erection of a new transformer station, contracts for which have already been placed. Plans for next year include extension of boiler facilities, new coal storage building and warehouse. F. A. Nash is president of the company.

ATLANTIC CITY, N. J.—The contract for construction of a new pumping station at Absecon, bids for which were opened June 28, was awarded to Edward L. Baden, Bartlett Building, Atlantic City, N. J., for $48,200. F. A. Chapman, of Atlantic City, N. J., has secured the contract for wiring the station at $2,240. Contracts for electric equipment for the station have already been placed. L. Van Gilder is superintendent and engineer of Water Department.

BURLINGTON, N. J.—The City Council has passed an ordinance granting a 50-year franchise to a syndicate with higher rates for municipal service. To become effective the ordinance must be signed by the Mayor, which has heretofore opposed long-term franchises without proper return to the city. The town has been agitating municipal ownership of electric plant.

RIVERSIDE, N. J.—The contract for the construction of a brick power house at Riverside, N. J., for the Philadelphia Watch Case Company has been awarded to the William Steele & Sons Company.

BELEN, N. M.—The County Commissioners have granted a franchise to M. W. Flournoy, of Albuquerque, N. M., to construct and operate an electric light plant in Belen.

LAS VEGAS, N. M.—It is reported that the lighting and traction systems of the Las Vegas Light & Power Company, which were recently taken over by the Federal Light & Traction Company, recently incorporated to take over and control several light and power companies in Colorado, New Mexico, Arizona and Wyoming, will be enlarged and improved and the service extended to Hot Springs.

ALBANY, N. Y.—The Federal Light & Traction Company of New York has filed a certificate with the Secretary of State showing an increase in capital stock from $2,000 to $11,000,000. The document is signed by M. Gregg Latimer, Emerson Stringham and W. Henry Hoyt.

BUFFALO, N. Y.—Extensive additions are being made to the plant of the United States Rubber Reclaiming Works at Babcock and Hannah streets and the Erie Railroad. The plant is operated by electricity generated at Niagara Falls and when the extension is completed between 2500 and 3000 hp will be used. One 1000-hp motor, one 200-hp and several motors will be installed. Frank H. Brewster, 724 Babcock Street, Buffalo, N. Y., is general superintendent.

DANSVILLE, N. Y.—The Public Service Commission, Second District, has granted the Dansville Gas & Electric Company permission to issue $10,000 in bonds, the proceeds to be used in payment of extensions and improvements to its plant in Dansville.

NEW YORK, N. Y.—The Independent Telephone Company has filed an application with the Board of Estimate for a franchise to construct and operate telephone wires through the low-tension subways and to lay wires throughout the streets of the city and to erect and maintain pole lines throughout the several boroughs.

NEW YORK, N. Y.—Contracts have been awarded by C. B. J. Snyder, superintendent school buildings, for repairs, alterations and additions to the electric equipment in public schools in the Borough of Manhattan to T. Frederick Jackson, 94 John Street, New York, N. Y., as follows: Public School 20, for $4,273; 40, for $3,282; 42, for $4,983, and 79, for $3 910.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until July 11 for completing and finishing the electric equipment in Public School 101, located on East One Hundred and Eleventh Street, near Lexington Avenue, Borough of Manhattan. Blank forms, original plans and specifications may be seen at the above office.

NEW YORK, N. Y.—Sealed bids will be received by the Board of Park Commissioners, Department of Parks, Arsenal Building, Fifth Avenue and Sixty-fourth Street, New York, N. Y., until July 21: (1) For furnishing material and installing electric lighting fixtures in the Metropolitan Museum of Art. (2) For furnishing and installing electric lighting fixtures in new addition (F) of the Metropolitan Museum of Art. (3) For furnishing material and labor required for changes in old electric feeder system and rearrangement of night light control for the Metropolitan Museum of Art. (4) For furnishing material and installing system of ventilation in the attic story of the east wing of the Metropolitan Museum of Art. Plans may be seen and blank forms obtained at the above office. Charles B. Stover is president of the Park Board.

SYRACUSE, N. Y.—Steps are being taken to secure the removal of all overhead wires of the Syracuse Lighting Company, the Bell Telephone Company and the Independent Telephone Company from the campus of the Syracuse University and the streets and avenues which surround the campus. It is understood that an informal agreement has been reached with the executive heads of the three companies by which the poles and wires shall be removed from the campus and its immediate environs and the lighting and telephone wires placed in conduits.

CANTON, OHIO.—Announcement has been made by the Canton Electric Company that extensive improvements will be made to its power plant located on East Seventh Street, which will involve an expenditure of about $400,000.

CINCINNATI, OHIO.—The Lunkenheimer Company, of Cincinnati, Ohio, is reported to be in the market for two gas engines with a rating of 200 hp each, to be used in connection with natural gas and producer gas, and which are to be direct connected to alternating-current motors to supply heat and power for the plant for the company at North Fairmont. The new equipment is to be installed in connection with the present power plant.

COLUMBUS, OHIO.—Sealed proposals will be received at the office of the Board of Trustees of the Ohio State University, Columbus, Ohio, until July 18 for the installation of a coal-handling and storage plant, including locomotive crane, at the power house at the Ohio State University, in accordance with plans and specifications prepared by David Gaehr, of Cleveland, Ohio, which are on file in the office of the State Auditor. Proposals will also be received at the same time and place for the installation of a hot-water heating and ventilating system in University Hall, at the Ohio State University, in accordance with plans and specifications prepared by J. A. Almirall, of New York, N. Y., which are on file in the office of the State Auditor.

CRESTON, OHIO.—Sealed proposals will be received by Charles A. Tenny, village clerk, until July 14 to supply electricity for an electric light system; also for the installation of an electric street lighting system.

HAMILTON, OHIO.—At a special election held June 25 the proposition to issue $260,000 in bonds, the proceeds to be used for extensions to gas, water and electric light systems, was carried.

SANDUSKY, OHIO.—Preparations are being made by the Auto Parts & Motor Truck Company for the construction of a new plant in Sandusky, Ohio, to be in operation by next fall. The plant, it is said, will be equipped for electric motor drive.

TOLEDO, OHIO.—It is reported that the City Council has instructed the Director of Public Service to purchase an auxiliary pump and motor for the municipal filtration plant.

FORAKER, OKLA.—It is reported that the proposition to issue $5,000 in bonds, the proceeds to be used for the construction of an electric light plant, was carried at an election held recently.

LAWTON, OKLA.—Plans are being prepared by the Pioneer Telephone Company for the construction of a new telephone exchange building in Lawton, to cost $80,000.

SAPULPA, OKLA.—The Oklahoma Union Traction Company, it is reported, will commence work at once on the construction of its proposed interurban railway between Sapulpa and Tulsa. The line will traverse the Glenn Pool oil fields.

KLAMATH FALLS, ORE.—Extensive improvements are contemplated by the Klamath Development Company, which will involve an expenditure of about $150,000, and will include the construction of an electric street railway system to take the place of the old horse car line which was recently acquired by the company. A subsidiary company, known as the Klamath Falls Land & Traction Company, has been formed to operate the street railway and the Buena Vista properties recently purchased by S. O. Johnson, president of the Klamath Development Company, and associates. Mr. Johnson is also president of the traction company.

LAKEVIEW, ORE.—Arrangements are being made for the erection of a power plant on Deer Creek, 22 miles east of Lakeview. Surveys of the falls are now being made for location of the plant. It is estimated that about 7000 hp can be developed. Work on construction of the plant will commence this summer. J. Lewis and G. McDonald, of Spokane, Wash., are reported to be interested in the project.

FORD CITY, PA.—Contracts have been awarded by the Pittsburgh Plate Glass Company for structural steel for its new plant to be erected at Ford City, Pa. The plant will be operated by electricity, which will be supplied by gas engine-driven units.

PHILADELPHIA, PA.—Preparations are being made by the Philadelphia Rubber Company for the erection of a warehouse at its plant at Thirty-seventh and Reed streets. An electric elevator will be installed.

PHILADELPHIA, PA.—The Philadelphia Electric Company is reported to have awarded the contract for the construction of a storage plant, 90x150 ft., on Randolph and Twenty-first Streets, to John R. Wiggins & Company, 1215 Filbert Street, Philadelphia, Pa. John T. Windrim is architect.

PITTSBURGH, PA.—Heyle & Paterson, Inc., of Pittsburgh, Pa., are reported to be in the market for a second-hand traveling crane of from 5 to 10 tons' capacity, and 40 to 60 ft. span.

READING, PA.—Plans are being prepared by the Metropolitan Electric Company for placing its wires underground throughout the business section of the city.

SOMERSET, PA.—Charles Griffith and associates, of Johnstown, Pa., have purchased the controlling interest in Somerset County Telephone Company of Frank John, of Philadelphia, Pa.

WESCOSVILLE, PA.—The contract for constructing an electric light and power plant and sewerage system and fire service at the Lehigh County Home, located near Wescosville, Whitehall Township, has been awarded to George H. Hardner, of Allentown, Pa., for $49,000. J. S. Troxell is clerk Board of Commissioners.

NEWPORT, R. I.—A project has been started by a number of the merchants on Thames Street, Newport, to light the street by electricity during the summer evenings. The business men propose to bear the cost of the illumination.

PROVIDENCE, R. I.—The E. K. Watson Company, of Warren, R. I., has been awarded the contract for the construction of an addition to the electric power station of the Browne & Sharpe machine shops in Providence, R. I.

GREENVILLE, S. C.—Application has been made to the City Council by J. Thomas Arnold, representing a power company, for a franchise in this city.

GREENVILLE, S. C.—The directors of the Pelzer Cotton Mills have subscribed $33,000 to the capital stock of the Greenville-Spartanburg-Anderson electric railway, and the Belton Mills have subscribed to $14,000 of the capital stock of the company.

GREENVILLE, S. C.—It is reported that the power plant of the Greenville Carolina Power Company, which was recently purchased by the Southern Power Company, of Charlotte, N. C., will be greatly enlarged by the new owners. The purchase price of the plant is said to be about $250,000. W. S. Lee, of Charlotte, N. C., is vice-president and chief engineer of the Southern Power Company.

CENTER, TEX.—The Center Electric Light & Power Company has filed an amendment to its charter, changing its name to the Center Ice, Light & Power Company, and increasing the capital stock from $15,000 to $20,000.

KARNES CITY, TEX.—It is reported that R. L. Spillar, of Manor, Tex., is contemplating the construction of an electric light plant in Karnes City, Tex.

MISSION, TEX.—The Minneapolis Steel Company, of Minneapolis, Minn., has submitted a proposition to the City Council to install an electric light and ice plant in Mission. The cost of the plant is estimated at about $13,000.

NACOGDOCHES, TEX.—The City Council has instructed the fire committee to secure estimates of the cost of installing an electric light plant in connection with the water-works system.

STAMFORD, TEX.—J. E. Johnson, of Stamford, Tex., is planning to install an electric light plant in Spur, Tex.

TERLINQUA, TEX.—The Chinos Mining Company is reported to be contemplating the installation of an electric light plant, and ice plant at its mines.

TYLER, TEX.—Arrangements are being made by the Banner Telephone Company for extending and improving its telephone lines both in and out of the city. H. E. Scovern, of St. Joseph, Mo., electrical engineer, will have charge of the work.

WACO, TEX.—The Waco Gas Company is reported to be contemplating increasing the output of its plant. The company has recently awarded a contract for a new steel gas holder.

EPHRAIM, UTAH.—Work has commenced by the Belknap Power Company on the construction of its power plant at Belknap, Sevier County. The proposed plant will have an ultimate output of about 9000 hp. The initial installation will furnish 150 hp, which will be transmitted to Joseph, Elsinore and Richfield. A tunnel 1400 ft. in length is now being driven through the neck of Horseshoe Bend, which will save the expensive construction of flumes and canals. William Seegmiller, of Richfield, Utah, is president; William Johnston, treasurer, and J. B. Weimer, manager of the company.

FARMINGTON, UTAH.—The Home Telephone Company has purchased the plant and holdings of the Davis County Light & Power Company. It is understood that the price paid for the plant was $50,000. The plant now furnishes electricity in the towns of Clearfield, Hooper and Lagoon. The new owners propose to extend the transmission lines all over Davis County and into Weber County, where franchises have recently been secured. John Ford, of Centerville, is president of the light company, and S. S. Howard, of Woods Cross, is president of the telephone company.

SALINA, UTAH.—The local electric light plant has been purchased by a company headed by John Monson, Hugh Lisonbee and Milan Packard, which will take possession July 15. A new power site has been secured at Rattlesnake Hill, 4 miles above the present plant on the Salina Canyon.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has placed a contract with the Risdon-Alcott Turbine Company, of Mount Holly, N. J., for a pair of 30-in. water wheels with a rating of 1800 hp, to be installed at the Carvers Falls plant.

LEW, VA.—It is reported that L. Jackson, agent, is in the market for equipment for a vinegar plant, including electric generators, hydraulic press, etc.

LURAY, VA.—The contract for lighting the streets of the towns has been awarded to the Shenandoah River Light & Power Company, of Luray, Va., for $600 per annum.

NORFOLK, VA.—The Portsmouth & Norfolk Traction Company, through its failure to execute a contract for lighting the streets of Portsmouth has forfeited a certified check for $5,000, which it deposited as a guarantee to carry out the contract. It is said that negotiation may be reopened with the corporation.

REEDVILLE, VA.—The Coast Fishing Corporation, recently incorporated, with a capital stock of $200,000 to establish a menhaden fertilizer plant, is reported to be contemplating the construction of several buildings to cost about $25,000. An electric light plant of sufficient output to supply 500 lamps will be installed; also conveyors, elevators, etc. The company, it is said, would like to receive estimates on two 60-hp, three 20-hp and five 35-hp engines.

RICHMOND, VA.—The Richmond & Henrico Railway Company has awarded the contract for boilers for its proposed new power plant to be erected on Louisiana Street, in Fulton, to the Babcock & Wilcox Company. The cost of the work is estimated at $10,000.

STAUNTON, Va.—The contract for lighting the streets of the city has been awarded by the Common Council to the Staunton Lighting Company, at a cost of $6,000 per year. It is estimated that the city will save about $1,000 a year. The city has a municipal electric light plant, which it has operated for 25 years.

BELLINGHAM, WASH.—The power plant on York Street of the Whatcom County Railway & Light Company is being torn down to make way for the new plant.

BLAINE, WASH.—Farmers of the Birch Bay district, Pleasant Valley and Mountain View are contemplating the construction of an electric railway from Ferndale to Blaine, via Lake Terrell and Birch Bay, for which five miles of right of way has already been donated.

CENTRALIA, WASH.—It is reported that contracts have been awarded by the Twin City Light & Traction Company for the construction of a new power plant, to be located on Coal Creek, about four miles from Centralia. The cost of the plant is estimated at $150,000.

ELLENSBURG, WASH.—The City Council has granted A. Olson, C. O. Eidel, A. F. Currier and F. Wippel a franchise to supply electricity in Ellensburg for lamps and motors.

MEDICAL LAKE, WASH.—A franchise has been granted the Medical Lake Telephone Company for the construction of a telephone system in Medical Lake.

NEWPORT, WASH.—The Northern Idaho & Montana Power Company has entered into a contract with the Washington Power Company, of Spokane, Wash., to provide electricity for lamps and motors for the cities of Sandpoint, Newport and intervening points for a period of 10 years. In order to supply the service the Washington Power Company will erect a high-tension transmission line from its power plant at Little Falls, on the Spokane River, to Newport, Wash., 70 miles in length. The Northern Idaho & Montana Power Company controls and operates electric light and power plants between Kalispel, Mont., and Newport, Wash.

ODESSA, WASH.—The City Council has accepted the bid of the Washington Water Power Company for materials and supplies for equipping the city water pumping plant to be operated by electricity, the cost not to exceed $1,376.

SALEM, WASH.—Extensive improvements are contemplated by the Salem Electric Company, which will involve an expenditure of about $200,000. It is proposed to build an addition to its plant and install new generating machinery and also improvements to its distributing system in Salem. It will also build a conduit system at a cost of $100,000. The company is also planning to improve its plant on Peabody Street at a cost of $75,000.

SPOKANE, WASH.—The Star Telephone Company is reported to have been granted a franchise to operate a telephone system in Ochlare, a new town on the Inland Empire system, about two miles south of Spokane.

VANCOUVER, WASH.—The Vancouver, Camas & Washougal Traction Company is reported to be contemplating the construction of an electric railway across the lands of the Vancouver Barracks military reservation, for which right of way has been applied for.

ELKINS, W. VA.—The Elkins Electric Railway Company is planning to construct a new power plant during the summer and also expects to build 7 or 8 miles of tracks within the next three months. F. B. Bloomfield, is general manager.

MILBOURNE, W. VA.—Surveys are being made by the Middle Railroad Company for the construction of its proposed electric railway to connect Sistersville, Kidwell, Middlebourne, Shirley and Clarkesburg, 60 miles in length. The company also proposes to furnish electricity for lighting. T. Moore Jackson, of Clarkesburg, W. Va., is president of the company.

CUBA CITY, WIS.—The new ore reduction plant of the Campbell Magnetic Separating Company now under construction, near Cuba City,

Wis., will be equipped for electric motor drive throughout. Electricity for operating the plant will be supplied by the Interstate Light & Power Company, of Galena, Ill.

EDGERTON, WIS.—Arrangements are being made by the Edgerton Wagon Manufacturing Company, of Edgerton, Wis., for the construction of a new plant, which will be equipped for electric motor drive throughout.

FOND DU LAC, WIS.—Preparations are being made by the Northern Casket Company, of Fond du Lac, Wis., for the construction of two new buildings, for which power equipment will be required, including boilers, electric motors and other machinery. Contracts for part of the machinery, it is said, have been placed.

JANESVILLE, WIS.—An addition is being erected to the foundry of the Janesville Machine Company, of Janesville, Wis. The equipment will include a 10-ton cupola, monorail crane and hoist, and motor-driven blower. It is understood that orders have been placed for most of the apparatus.

LA CROSSE, WIS.—Negotiations are reported to have been closed between the La Crosse City Railway Company, of La Crosse, Wis., and the La Crosse Gas & Electric Company, whereby the latter company will furnish electricity to operate the electric railway system. It is understood that it will be necessary for the La Crosse Gas & Electric Company to increase the output of its plant, which will require the installation of additional equipment, plans for which have not yet been completed.

WEST ALLIS, WIS.—It is reported that estimates have been taken for the construction of a new plant for the Kempsmith Manufacturing Company, of Milwaukee, Wis., to be located at West Allis. A power house will be erected, 50x100 ft., in which a steam electric generating plant will be installed. The machinery will be equipped for electric motor drive.

NEW WESTMINSTER, B. C., CAN.—The British Columbia Electric Railway Company is reported to be contemplating extending its railway system to Millside in the near future. Work on the construction on the Lulu Island section, it is said, will commence soon.

VANCOUVER, B. C., CAN.—The Vancouver Power Company, a subsidiary of the British Columbia Electric Railway Company, is reported to have announced plans for development of 100,000 hp, which will involve an expenditure of about $10,000,000.

LONDON, ONT., CAN.—Announcement has been made of rates for electricity furnished by the system of the Hydro-Electric Power Commission. For motors for manufacturing purposes the rate will be from $40 to $50 per horse-power per year; for lamps for residences 6½ cents per kw-hour with 20 per cent discount, making the rate about 50 per cent less than the rates now charged by the London Electric Company.

New Industrial Companies.

THE ALPHA CONTRACTING & ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Thompson W. Miller, of Flushing, N. Y.; Robert T. Rasmussen and Henry Hetkin, both of 896 Park Avenue, Brooklyn, N. Y. The company proposes to do a general construction business.

THE ATLAS WATER TUBE BOILER COMPANY, of Westmont, N. J., has been chartered with a capital stock of $300,000 by P. J. Dougherty, J. B. Rettew, of Philadelphia, Pa., and J. Q. Adams, of Westmont, N. J. The company proposes to manufacture water-tube boilers, etc.

THE AUTOMOBILE ENUNCIATOR COMPANY, of Chicago, Ill., has been chartered with a capital stock of $500,000 by S. F. Harris, W. I. Patton and A. E. Wilson, of Chicago, Ill. The company proposes to manufacture electrical supplies and apparatus.

THE AUTOMATIC FEED REGULATOR & SPECIALTY COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $200,000 to manufacture and deal in apparatus relating to water, steam, gas, etc. E. J. Burnham, of Kittery, Maine, is president, and H. P. Knowlson, of Malden, Mass., treasurer.

THE BALANCE GEAR LIGHT VEHICLE COMPANY, of New York, N. Y., has been chartered with a capital stock of $30,000 by Walter E. McDonnell, of New York, N. Y.; Thomas Spaulding, of Long Island City, N. Y., and Michael J. McDonnell, of Far Rockaway, N. Y. The company proposes to manufacture vehicles, motors, engines of all kinds.

THE BOULEVARD ENGINE COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $10,000 by Howard B. Gentry, N. S. Brown, B. C. Winston and others.

THE COMO ELECTRICAL COMPANY, of Como, N. J. (not a post office), has been incorporated by W. W. Rowan, of Asbury Park, N. J.; T. Hickley, Spring Lake, N. J., and W. E. Anderson, of Englishtown, N. J. The company is capitalized at $50,000 and proposes to manufacture electrical and mechanical devices.

THE COMET ELECTRIC STOVE COMPANY, of Detroit, Mich., has been incorporated with a capital stock of $50,000 by James D. Lamont, Ellsworth S. Bryant and Franklin S. Prussia. The company proposes to manufacture electric stoves and heaters.

THE CROUCH CONSTRUCTION COMPANY, of Jersey City, N. J. has been chartered with a capital stock of $100,000 by H. O. Coughlan, L. H. Gunther and H. A. Black, of Jersey City, N. J.

THE GOTHAM MOTOR CAR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 by W. Schuette, R. W. Schuette, of Douglas Manor, and D. W. Gluck, of New York, N. Y. The company proposes to manufacture and deal in motors, engines, motor cars, etc.

THE GUNN MOTOR COMPANY, of Utica, N. Y., has been incorporated with a capital stock of $300,000 to manufacture and deal in motors, engines, etc., by J. K. Dunn, W. T. Baker and W. I. Taber, of Utica, N. Y.

THE HAMPSHIRE MANUFACTURING COMPANY, of New York, N. Y., has been incorporated by C. J. Kleber, of New York, N. Y.; J. MacGregor, of Springfield, Mass., and J. H. Kaesen, of New York, N. Y. The company is capitalized at $125,000 to manufacture and deal in machinery, tools and appliances.

THE KERBEAUX COMPANY, of New York, N. Y., has been chartered with a capital stock of $1,000 to manufacture packings, power and mill supplies. The incorporators are: Irving D. Lyon, 715 West Eightieth Street, New York, N. Y.; August Voelker, New York, N. Y., and Charles P. Hull, Metuchen, N. J.

THE LEHIGH ENGINEERING CONTRACTING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000. The incorporators are: E. L. Brooks, of Kyserine, N. Y.; T. E. Ryan, Eddystone, Pa., and M. Shapiro, of Brooklyn, N. Y.

MASON, HILTON & COMPANY, of New York, N. Y., has been incorporated by F. Mason, of Brooklyn, N. Y.; J. C. Hilton, of Hackensack, N. J., and A. L. Mason, of New York, N. Y. The company is capitalized at $50,000 and proposes to do a general engineering, contracting and building business.

THE MAXIMILIAN, TOOL & MACHINE COMPANY, of Buffalo, N. Y., has been incorporated by Max Maximillian, Fred A. Meyer and John B. Porter, of Buffalo, N. Y. The company is capitalized at $500,000 and proposes to manufacture and deal in machinery, tools, etc.

THE McMAHON CONSTRUCTION COMPANY, of Newark, N. J., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general contracting and construction business. The incorporators are: J. McMahon, P. J. McGuinness and L. W. McMahon, all of Newark, N. J.

THE MIDDLE WEST ENGINEERING COMPANY, of Cincinnati, Ohio, has been chartered by James E. Hewes, F. C. Busch, C. B. Matthews and Randolph Matthews. The company is capitalized at $100,000 and proposes to do a general engineering and construction business. James E. Hewes will be president of the company.

THE MONTROSE MANUFACTURING COMPANY, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $100,000. The company proposes to manufacture and sell electrose products. The incorporators are: L. Steinberger, of Brooklyn, N. Y.; J. H. Poppenburg and F. Sternberger, of New York, N. Y.

THE NIAGARA LEAD & BATTERY COMPANY has filed articles of incorporation with the Secretary of State with a capital stock of $5,000,000. The incorporators are: G. O. Parkman and William W. Hepburn, of Philadelphia, Pa., and Edward C. Waddington, of Woodtown, N. J. The company proposes to manufacture electrical supplies.

THE NORTH AMERICAN RAILWAY SPECIALTY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 to manufacture railway supplies and rolling stock. The incorporators are: S. J. Cotsworth, S. P. Gough and E. M. Fry, of Chicago, Ill.

THE OLD COLONY CONSTRUCTION COMPANY, of Boston, Mass., has been chartered with a capital stock of $50,000 to do a general contracting and building business. R. E. Davis, of Brookline, Mass., is president and treasurer.

THE O-SIGN ELECTRIC COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by J. L. Cockle, F. L. Phillips, J. P. Patterson, of New York, N. Y. The company proposes to do a general advertising business, constructing electrical advertising devices.

THE EDMUND T. PERKINS ENGINEERING COMPANY, of Augusta, Maine, has been chartered with a capital stock of $100,000 to do a general engineering, construction and contracting business. R. S. Buzzell is president and A. F. Jones, treasurer, both of Augusta, Maine.

THE ST. MARKS BUILDING COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 for the purpose of manufacturing and dealing in pumps, dynamos and machinery; also conducting a real estate agency. The incorporators are: Archibald K. Meserole, 784 Manhattan Avenue, New York, N. Y.; N. Marsila and James J. Murray, both of New York, N. Y.

THE UNITED ELECTRICAL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Loyal L. Smith, Austin J. Rooney and John J. Rooney. The company proposes to do a general electrical construction business.

THE WIRT ELECTRIC SPECIALTY COMPANY, of Portland, Maine, has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in all kinds of electrical and other apparatus, machinery, etc. T. L. Croteau is president of the company and A. F. Jones, treasurer, both of Portland, Maine.

New Incorporations.

ABBEVILLE, ALA.—Articles of incorporation have been filed for the Abbe Light & Power Company with a capital stock of $6,000. The officers of the company are: J. S. Pollard, president; J. L. Bodiford, vice-president, and C. J. Owens, secretary and treasurer.

BAY MINETTE, ALA.—The Alabama Telephone & Telegraph Company has been incorporated with a capital stock of $5,000 and proposes to operate telephone lines in Baldwin, Conecuh, Escanabia, Monroe and Washington Counties. The officers are: Ellis L. Munna, president; Spaulding Peck, secretary and treasurer, and J. H. Haswell, general manager.

OROVILLE, CAL.—The Butte & Plumas Railway Company has applied for a charter to construct an electric railway to connect Oroville and Standwood, a distance of 30 miles, surveys for which are now being made. The capital stock of the company is placed at $500,000. The incorporators are: O. C. Hasslett, E. S. Dunbar and J. L. Smith.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has been incorporated with a capital stock of $6,500 000 by W. T. Spring, F. J. Hensel and J. M. Lindsay, of Wilmington, Del.

FOREST CITY, IA.—Articles of incorporation have been filed for the Forest City & Mason City Railway Company by P. O. Koto, C. N. Christopherson, C. S. Isaacs, of Forest City, Ia.; A. M. Sheimo, of Baldwin, Wis.; A. L. Sherin and M. J. Hawley, of Watertown, S. D The company is capitalized at $400,000 and proposes to construct a railway in South Dakota from Forest City, via Fertile to Mason City, a distance of 30 miles

VANDALIA, ILL.—The Fayette County Telephone & Telegraph Company has been incorporated with a capital stock of $48,500 by William M. Crouch, John U. Metzger, Charles M. Ratterjohn.

MAQUOKETA, IA.—The Washington Farmers' Mutual Telephone Company has been chartered with a capital stock of $2,000 by E. W. Burnett, W. E. Roe and others.

PORTLAND, MAINE.—Articles of incorporation have been filed for the Pacific Power & Light Company with a capital stock of $7,500,000. The company is a subsidiary of the American Power & Light Company and has taken over the following properties: Gas properties in Walla Walla and North Yakima, Wash.; Lewiston, Idaho, and Astoria and Pendleton, Ore.; also electric properties in Walla Walla, Astoria, Pendleton and Athena and the local electric railway systems in Astoria and in Walla Walla and interurban railway extending from Walla Walla to Milton; the Strahorn properties, consisting of electric light, power and water systems in North Yakima and along the valleys of the Columbia and Yakima rivers.

ASH GROVE, MO.—The Ash Grove Telephone Company has been chartered with a capital stock of $15,000 and the following directors: J. T. Kirkland, A. K. Kirkland and J. Francis Kirkland.

FAIRFAX, MO.—The Fairfax Light, Heat & Power Company has been chartered with a capital stock of $5,000 by William F. Ranken, William F. Marshall and E. C. Whitford.

ILLMO, MO.—The Illmo Light & Power Company has been incorporated with a capital stock of $4,000 by J. H. Beisswingert, John S. Norman, D. T. Doty and others.

NEVADA, MO.—The Nevada Water, Light & Traction Company has been chartered with a capital stock of $350,000 by Henry C. Barker, William W. Seibert, Edward Willard and others.

SAVANNAH, MO.—The Savannah Electric Light & Power Company has filed articles of incorporation with a capital stock of $15,000 by F. C. Barrington, William A. Evans and Z. L. Zwick.

OMAHA, NEB.—The Niobrara Investment Company has applied for a charter for the purpose of constructing an interurban railway extending between Niobrara River and Sioux City. A power plant will be built on Niobrara River. The company is capitalized at $1,200,000. F. Jaeggi is interested in the project.

STONE HARBOR, N. J.—Articles of incorporation have been filed for the Stone Harbor Electric Light & Power Company by H. S. Risley, D. R. Risley, R. P. Risley, of Stone Harbor, N. J.; C. A. Farnum, of Philadelphia, Pa., and E. C. Waddington, of Woodstrom, N. J. The company is capitalized at $100,000 and proposes to operate electric light, heating and power plants in Stone Harbor and the lower portion of Seven Mile Beach.

TRENTON, N. J.—The Riverside Traction Company has been incorporated with a capital stock of $1,500,000 to take over the property of the Camden & Trenton Railway Company. The officers of the company are: Thomas Haydock, of Philadelphia, Pa., president; Dietrich Debuys, of Camden, N. J., secretary, and Robert Long, of Philadelphia, Pa., treasurer.

BELEN, N. M.—The Belen Light & Power Company has been incorporated by W. M. Berger, Oscar Goebel, Mary E. Berger, of Belen, N. M., and Charles H. Scholl, of Los Angeles, Cal. The company is capitalized at $25,000 and has secured a franchise to furnish electricity in Belen. It is expected to have the plant in operation within three months.

ALBANY, N. Y.—The Maples Telephone Company has been incorporated by A. N. Pruner, A. W. Kressler and L. W. Kester, all of Salamanca, N. Y. The capitalization is $5,000.

OVERLY, N. D.—Articles of incorporation have been filed for the Overly Farmers' Telephone Company with a capital stock of $25,000 by Fred E. Sims, John Schuchard, C. Foss, Peter Boardman, T. E. Morgan and others.

STANLEY, N. D.—The Sunny Center Telephone Company has been chartered with a capital stock of $5,000 by Peter Ilson, Amos E. Lande, of Belden, N. D., Dayton H. Dody, Martin Holter and G. J. Gilbertson, of Stanley, N. D.

NELSONVILLE, OHIO.—Articles of incorporation have been filed for the Hocking Light & Power Company by H. H. Long, G. M. Murray, C. H. Davis, L. S. Madden and G. H. Sweetland. The company is capitalized at $10,000 and proposes to acquire and operate transmission lines for the distribution of electricity for lamps and motors in Nelsonville and vicinity.

KENNARD, PA.—The Kennard Telephone Company has been chartered with a capital stock of $5,000.

LAKE SIDE, R. F. D. SUSQUEHANNA, PA.—The Lake Side Telephone Company has been organized with a capital stock of $10,000.

TAYLORSTOWN, PA.—The Taylorstown Farmers' Telephone Company has been incorporated with a capital stock of $5,000 by J. G. Snodgrass, R. W. Wolfe, W. G. Cundell, W. H. Phillips, J. F. Kerr and G. R. Conger, of Taylorstown, Pa., and N. O. Braundell, of Carothers, Pa.

NASHVILLE, TENN.—A charter has been granted to the Overton branch of the Home Telephone system with a capital stock of $5,000. The incorporators are: B. L. Speck, J. A. Hargrave, W. J. Chilton, A. G. Keisling, W. A. Reed, Jesse S. Fleming and A. J. Mofield.

CLINT, TEX.—The Clint Telephone Company has been incorporated with a capital stock of $2,500 by C. M. McKinney, R. H. Davidson and C. D. Bubble.

VIENNA, VA.—Articles of incorporation have been filed for the Washington-Virginia Railway Company with a capital stock of $1,000,000 to construct an electric railway from Vienna to Belmont, 50 miles in length. The officers are: M. E. Church, president; G. B. Fadsley, vice-president; F. B. Parker, secretary, and L. L. Northrop, treasurer, all of Falls Church, Va.

ONTARIO, WIS.—The Ontario & Northern Railway Company has been granted a charter to construct an electric railway from Ontario to Wilton, a distance of 8 miles. The company is capitalized at $75,000, and the directors are: V. A. Stoddard, C. W. Lord, A. T. Saunders, L. R. Abbott, F. G. Bredlow and Levi Wallace, all of Ontario, Ont.

Personal.

MR. JOHN C. PARKER, electrical engineer of the Rochester (N. Y.) Railway & Light Company, was married June 21 to Miss Elizabeth Brooks at Rochester.

MR. L. W. JACQUES, master mechanic of the Fort Wayne & Wabash Valley Traction Company, with offices at Fort Wayne, Ind., was married June 22 to Miss Jennie Schroyer, of Zanesville, Ohio.

MR. JOHN E. ROBERTS has been appointed a member of the electric lighting board of Jamestown, N. Y., which operates a municipal plant. Mr. Roberts was at one time employed by the plant as electrician, and recently has been an alderman.

MR. W. R. WILSON has been appointed director of industrial enquiries and industrial education in the United Provinces of Agra and Oudh, India, with headquarters at Allahabad. Mr. Wilson was formerly engineer of the Simla hydroelectric plant.

PROF. D. C. JACKSON, of the Massachusetts Institute of Technology, president-elect of the American Institute of Engineers, was the guest of honor at a dinner of Cornell alumni held at Jefferson, N. H., on June 30 during the convention of the A. I. E. E.

MR. HAROLD D. LARRABEE, manager of the Green Mountain Electric Company, Montpelier, Vt., has been appointed superintendent of the Consolidated Lighting Company, of that city, to succeed Mr. E. O. Wedge. Mr. Larrabee is a graduate of the Massachusetts Institute of Technology.

MR. E. O. WEDGE, who has been with the Consolidated Lighting Company, Montpelier, Vt., for the past 18 years, and is now its superintendent, has resigned his position to become general manager of the Astoria Electric Company, which controls the electric railway, electric lighting and gas lighting properties at Astoria, Ore.

MR. GEORGE R. WEBB, of Baltimore, Md., will become vice-president of the new merger of the Philadelphia & Wilmington Traction Company and the Wilmington Light & Power Company. Before the merger Mr. Webb was a large holder in the latter company.

PROF. MIKIL A. DE CHATELAIN, of the department of electrical engineering, Wasily Ostow, St. Petersburg, Russia, is in this country visiting points of interest to electrical engineers. He attended the recent convention of the A. I. E. E., of which he is a member.

MR. SILAS E. WEIR has accepted a position with the Triumph Electric Company, of Cincinnati, as shop superintendent. Mr. Weir, who was formerly connected with the Western Electric Company, of Chicago, has had a long and varied experience in the manufacture of direct and alternating-current machinery.

MR. M. J. KEHOE, superintendent of power in charge of operation of the main plant of the Fort Wayne & Wabash Valley Traction Com-

pany, at Fort Wayne, Ind., has been promoted to be also superintendent of the light and power department of the company, which does the commercial lighting in Fort Wayne. Mr. John B. Weidgenant is assistant superintendent.

Trade Publications.

WATER METERS.—Water meters, designed especially for that class of services known as fire services in distinction to those known as manufacturing or commercial services, are illustrated, described and listed in bulletin issued by the Hersey Manufacturing Company, South Boston, Mass.

PANEL BOARDS.—The J. Lang Electric Company, Cleveland, Ohio, is distributing an attractive poster, printed in three colors, showing its panel board designed particularly for use in office buildings and similar localities. Tables are given of the sizes of wires for use with motors or for carrying a known value of current.

INTERCOMMUNICATING TELEPHONES.—Telephone systems for interior use, as in hotels, factories, apartment houses, etc., form the subject of catalog 21 of the Connecticut Telephone & Electric Company, Meriden, Conn. Different types of instruments and switchboards are described and connection diagrams given.

IGNITION DEVICES.—The Eisemann Magneto Company, 225 West 57th St., New York, has issued a well-arranged folder giving instructions for the installation and maintenance of high-tension magnetos with separate transformer coils. A description of the Eisemann magneto is given in bulletins Nos. 20 and 21 of the company.

LINE DROP COMPENSATORS.—In bulletin No. 4740, issued by the General Electric Company, there is described a line-drop compensator for alternating-current circuits, which can be applied to switchboards already installed without any radical changes in the existing panels and can be mounted at any convenient place behind the panel or on the wall, the small leads only being brought to the instrument on the panel.

HEMMING INSULATION.—A handsome booklet issued by the Hemming Manufacturing Company, 2 Rector Street, New York, describes "Hemit," an insulating composition molded under high pressure into various forms and shapes, illustrations of a number of which are shown. It is stated that all electrical insulators, or insulated parts of electrical machinery or apparatus, may advantageously be made of "Hemit."

ENAMELED MAGNET WIRE.—With the title "Enameled Magnet Coil and Electromagnetic Windings," the American Electric Fuse Company, Muskegon, Mich., has issued a handsome pamphlet, which will be found of much interest by users of small wire and of electromagnets. An account is given of the development of the enameled type of wire insulation, and comparisons made with cotton and other fiber coverings as to winding space occupied and break-down voltage. In an appendix sample formulas are given for calculating coil windings. Numerous halftones are given illustrating coils, their winding, etc.

SERIES TUNGSTEN LIGHTING SYSTEM.—The Western Electric Company has issued bulletin No. 5533, describing series incandescent lighting system with tungsten lamps. The bulletin gives details of and operating data for lamps and constant-current transformers suitable for use on series lighting circuits. It lists standard switchboard panels for controlling lighting circuits, and pole brackets, hoods and reflectors for use in the construction of these circuits. A new device brought to notice is the safety automatic cut-out, a device for protecting series street lighting circuits in case any portion becomes ruptured.

BUSINESS NOTES.

ATLANTIC INSULATED WIRE & CABLE COMPANY, 120 Liberty Street, New York, has appointed Mr. Samuel D. Gloss, formerly with the Simplex Electrical Company, sales manager, to succeed the late Mr. George F. Porter.

THE LORD MANUFACTURING, The Lord Electric and the Lord Construction companies are taking contracts for lighting installations for parks, municipalities, factories and mills. In these contracts they are supplying their "Luminator" flaming arc lamps. It is claimed that these lamps give a wonderfully brilliant light and when hung at a sufficient height above the ground make an even, pleasing glow. Moreover, in rolling mills and factories the light is of such a character as to improve working conditions to a degree whereby the operating expenses in many instances have been considerably decreased.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon. Mobile, Ala. Next meeting, Anniston, Ala., 1910.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, 158 West 76th St., New York City.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia.

American Street & Interurban Railway Engineering Association. Secretary, John W. Corning, Boston Elevated Railway Company, Boston, Mass.

American Street & Interurban Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 509 Perry-Payne Building, Cleveland, O.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 135 Adams St., Chicago.

Association of Railway Electrical Engineers. Secretary, George B. Colegrove, 960 Monadnock Building, Chicago. Next annual meeting, Chicago, Oct. 4, 5, 6 and 7, 1910.

Association of Edison Illuminating Companies. Secretary, D. L. Huntington, Spokane, Wash.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allen H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, Glenwood Springs, Sept. 21, 22 and 23, 1910.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle and Central Station Association. Secretary H. T. Sands, 139 Pleasant St., Malden, Mass.

Electric Club, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon at Chicago Automobile Club.

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next annual meeting, Chicago, Nov. 3, 1910.

Electrical Supply Jobbers' Association. Next meeting Niagara Falls, Canada, July 19, 20 and 21, 1910.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Engineering Society of Wisconsin. Secretary, W. G. Kirchoffer, 31 Vroman Building, Madison, Wis.

Engine Builders' Association of the United States. Secretary, C. H. Lembower, Reading, Pa.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., 1911.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Light Association. Secretary, Fred Leslie, Muncie, Ind.

Internal Combustion Engine Association. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Rochester, N. Y., Sept. 6, 7, 8 and 9, 1910.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Annual meeting, second Wednesday in March, each year.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Kansas City, Kan., Sept. 27 and 28, 1910.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

MAINE ELECTRICAL ASSOCIATION. Secretary, Fred D. Gordon, Auburn, Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. P. Biggs, Detroit, Mich. Next meeting, Port Huron, Mich., Aug. 16, 17 and 18.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperthwait, Faribault, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Atlantic City, N. J., July 20, 1910.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, San Francisco, Cal., June 9, 1910.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, 89 Lafayette St., Boston, Mass.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, on board steamer *Queen*, leaving Seattle Aug. 26, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Cedar Point, Sandusky Bay, Ohio, July 26, 27 and 28, 1910.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla. Next meeting, Oklahoma City, Sept. 30 and Oct. 1, 1910.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PACIFIC COAST ELECTRICAL SHOW, San Francisco, Cal., week beginning Aug. 20, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa. Next meeting, Glen Summit Springs, Pa., Sept. 14, 15 and 16, 1910.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEGRAPH ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Lena M. Owen, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WASHINGTON ELECTRICAL SHOW, October or November, 1910.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill. Next meeting, Omaha, Neb., October, 1910.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WINNIPEG ELECTRICAL SHOW, Winnipeg, Manitoba, July 13 to 23, 1910.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 28, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

962,417. ELECTRICAL RECEIVING APPARATUS; J. M. Boyle, New York, N. Y. App. filed July 28, 1905. For high frequency oscillations in which the receiver consists of a two fluid primary battery, the conductive fluid connection of the fluids being of extremely small cross-section.

962,431. TYPE CARRIAGE PROPELLING MECHANISM FOR PRINTING TELEGRAPH RECEIVERS; G. S. Hiltz, Brooklyn, N. Y. App. filed Nov. 16, 1908. For effecting the return of the carriage from any point to its initial position.

962,435. INCANDESCENT LAMP SYSTEM; Y. Kawasaki, Vancouver, B. C., Can. App. filed July 28, 1908. A lamp with a plurality of filaments and a common terminal which may be connected to the several wires of a controlling circuit.

962,455. SERVICE CUT-OUT AND METERING APPARATUS; T. E. Murray, New York, N. Y. App. filed Dec. 21, 1909. For connecting any number of local circuits to their several meters independently with a protecting fuse, by means of a panel of blocks of insulating material in which the connections are embedded.

962,473. SWITCHBOARD CONSTRUCTION; W. M. Scott, Philadelphia, Pa. App. filed Nov. 9, 1909. Busbars extending across a switchboard, circuit leads, and a plurality of electric switches on the board and disposed vertically above each other with a movable contact member connecting a lead with a busbar.

962,497. VAPOR ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed Apr. 4, 1904. A vapor electric apparatus having a vaporizable electrode and a solid electrode in the same space as the vaporizable electrode and cooled by contact with fluid of the same character as the electrode.

962,499. ELECTRIC HAMMER; B. M. Dutton, Richmond, Va. App. filed Feb. 16, 1909. Electric reciprocating motor having two solenoids which alternately influence a plunger.

962,532. ELECTRIC FURNACE FOR METALLURGICAL PURPOSES; H. F. D. Schwahn, Belleville, Ill. App. filed March 24, 1909. For aluminum consisting of a annular furnace around a transformer having electrodes of carbon and refractory material.

962,533. TROLLEY SWITCH; F. L. Sessions, Columbus, Ohio. App. filed May 5, 1908. For crossing devices for trolley wires consisting of a plate carrying a wire with a threaded binding device and wire clamps.

962,536. LIGHTNING-ARRESTING APPARATUS; T. M. Stevens, Watertown, Mass. App. filed Jan. 3, 1910. For protecting oil tanks from lightning by means of spaced masts, a cable between, and a plurality of lightning arresters at intervals along the cable.

962,552. FIRE-ALARM; M. V. Crawford, Blaine, Wash. App. filed Feb. 4, 1909. Thermo fire alarm including a strand of horsehair for holding the elastic terminal away from the fixed terminal.

962,589. RECEPTACLE OR SOCKET FOR ELECTRIC LAMPS; W. S. Ryan, New York, N. Y. App. filed Aug. 21, 1909. Diagonally disposed holes for receiving a holding device and connecting and disconnecting the electrical conductors at will without severing them.

962,645. TELEPHONE SYSTEM; R. C. Livingston, Spring Valley, N. Y. App. filed May 21, 1908. Party line telephone system with a signal connected to the main line which is broken at two points, a separate bridge, normally closing the brakes, and a telephone under the control of a separate bridge.

962,655. APPARATUS FOR ELECTROPLATING PIPES, ETC.; D. H. Murphy, New Castle, Pa. App. filed June 1, 1908. A tank with plating solution in which a carrier supports the pipes and gives them a reciprocating rotary motion.

962,683. DYNAMO-ELECTRIC MACHINE; M. Walker, Manchester, England. App. filed June 5, 1905. Turbo-generator in which the slotted core carries bar conductors projecting beyond the end secured thereto by a plurality of connecting rings.

962,687. SIGNALING DEVICE; M. J. Wohl, New York, N. Y., and H. Hertzberg, Brooklyn, N. Y. App. filed March 16, 1908. Telephone receiver with diaphragm giving an audible signal by the vibration of the diaphragm through the expansion and contraction of a thermo conductor.

962,689. ELECTRICAL APPARATUS; C. Aalborg, Wilkinsburg, Pa. App. filed July 8, 1909. A tank or casing with a base having projecting teeth to co-operate with toothed sections or corrugated portions of a transformer placed within the tank so as to center it.

962,692. ARC-LAMP; T. J. Anderson, Houston, Tex. App. filed Nov. 30, 1908. Carbon holder with guiding tube supported by vertically disposed bar and clamp with a clutch.

962,694. PRINTING TELEGRAPH RECEIVER; Marie Burry, N. Y. Executrix John Burry, Deceased. App. filed Aug. 27, 1908. Type carrier setting mechanism including an electromagnet and a printing mechanism with actuating magnet, with a third magnet for causing the first two to actuate their mechanisms in the order named.

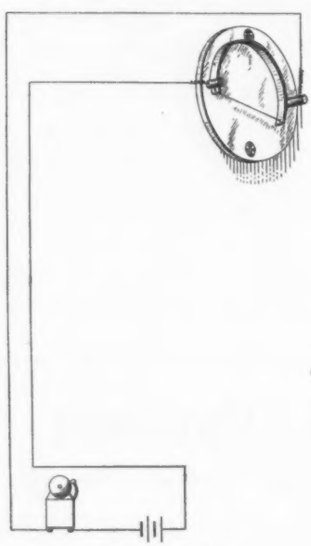
962,709. TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed July 9, 1906. For telegraphing on lines such as submarine cables with great capacity, by means of an alphabet having heavy lines above an imaginary zero line, the space consisting of a heavy line below and above the zero line.

962,713. ELECTROPNEUMATICALLY OPERATED CONTROLLER; J. N. Mahoney, Wilkinsburg, Pa. App. filed Sept. 3, 1907. A series of independently operated switches with an elastic fluid interlocking means and electro-responsive means for initiating the action of the switches.

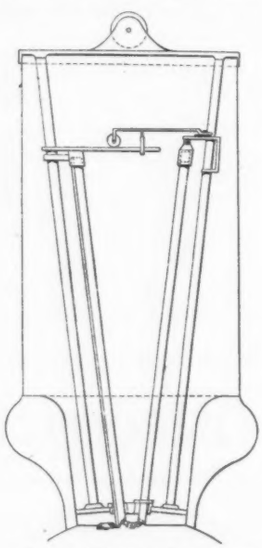
962,726. INSULATING BUSHING; C. H. Thordarson, Chicago, Ill. App. filed Jan. 29, 1910. An insulating bushing for electric wiring having a contractable spring screw threaded sleeve removably fitted thereto and arranged to be locked on the body when screwed into a screw threaded shell.

962,732. ELECTRIC ARC LAMP; H. Beck, Frankfort-on-the-Main, Germany. App. filed Nov. 15, 1906. For keeping a substantially uniform distance between the arcing ends of the electrode by means of a roller carried by one member with means carried by one of the members for preventing laternal displacement.

962,739. AUTOMATIC RAILWAY SWITCH; C. E. Brandfass, Wheeling, W. Va. App. filed Jan. 20, 1910. Electrically controlled switch operated by the motorman. Details.



962,552—Fire Alarm.



962,732—Electric Arc Lamp.

962,759. ELECTRIC MEASURING INSTRUMENT; R. H. Hickok, Atlanta, Ga. App. filed June 4, 1909. Wattmeter of the galvanometer type, having a fixed coil and a movable coil moving in opposition to the tension of a spring.

962,768. ELECTRIC SAD IRON; H. G. Levy, San Francisco, Cal. App. filed April 1, 1910. Has a removable handle which is reversible and an electrically heating unit in the body of the iron, the handle engaging contacts when applied to the body to make the circuit and breaking contact when removed.

962,772. FLEXIBLE CONDUIT; G. A. Lutz, Plainfield, N. J. App. filed June 6, 1908. Inner and outer strips suitably corrugated. the joint of one strip being out of line with the joint of the other strip.

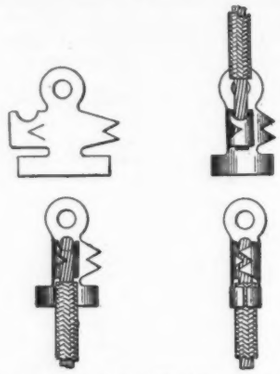
962,773. ELBOW FOR CONDUITS; G. A. Lutz, Plainfield, N. J. App. filed Aug. 3, 1908. One piece of sheet metal bent in channel form with open sides at right angles to each other.

962,774. ELBOW FOR CONDUITS; G. A. Lutz, Plainfield, N. J. App. filed Aug. 13, 1908. Open side members at an angle to each other, the open sides facing in different directions away from each other.

962,793. ELECTRIC HEATING UNIT; H. M. Smith, Pittsfield, Mass. App. filed March 29, 1909. The resistance conductor is enclosed in a metallic casing, the casing being bent around the unit without injury either to the unit or to the casing.

962,795. INCANDESCENT ELECTRIC LAMP; A. F. F. Stodd, Paterson, N. J. App. filed June 23, 1909. For throwing the light downwardly, the neck within the lamp having a plurality of annular enlargements carrying an incandescent filament.

962,800. TELEPHONE SYSTEM; J. B. Taylor, Schenectady, N. Y. App. filed May 3, 1909. Transmission circuit and switch, a transformer with one winding connected to the receiving and transmitting apparatus and a second winding connected through the switch to the transmission circuit and a bell connected across the circuit between it and the switch.



962,921—Terminal for Electric Conductors.

962,816. ELECTRICAL RECEPTACLE AND ROSETTE; L. J. Castonguay, Bridgeport, Conn. App. filed Dec. 17, 1908. A body with terminals and having a flange for securing it to the mouth of the conduit.

962,817. TIME LIMIT PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; H. W. Cheney, Norwood, Ohio. App. filed May 27, 1907. A thermo device heated by abnormal currents, the volume of thermal body varying under rising temperature and controlling an electric circuit whose conditions as regards opening and closing is reversed when the volume of the body reaches a predetermined value.

962,823. DEVICE FOR SINGEING TEXTILE FABRICS; G. Gin, Paris, France. App. filed March 30, 1908. The fabric is moved in contact with metallic surfaces heated to red heat by electric current, the surfaces forming the secondary circuit of a static transformer.

962,835. MOTOR CONTROL; H. Heymann, Berlin, Germany. App. filed Feb. 26, 1910. A separately excited generator supplies current to a motor, with means for varying the field of the generator and an auxiliary speed regulator for the motor normally locked in full field position and means for releasing the regulator when the motor reaches a predetermined position.

962,847. SPRING JACK STRUCTURE; H. J. Kuesl, Chicago, Ill. App. filed Nov. 20, 1905. Unitary spring jack for holding together the contact strips and jack thimble. Details.

962,856. STARTING DEVICE FOR ELECTRIC MOTORS; D. H. Plank and A. C. Finney, Schenectady, N. Y. App. filed March 1, 1910. Alternating-current motor with supply circuit transformer, and a plurality of switches for connecting the motor to the supply circuit through the transformer and then directly to the supply circuit after a predetermined interval.

962,870. STORAGE BATTERY; C. F. Washburn, New London, Conn. App. filed Aug. 12, 1909. For lessening the weight by using a strip of lead forming hollow poles and an aluminum plate bent and extending into said poles.

962,884. THERMO-ELECTRIC FURNACE REGULATOR; J. H. Bobbitt, Harvard, Neb. App. filed Oct. 7, 1908. For controlling the damper and check by means of a motor mechanism controlled by a thermostat. Also gives an audible signal and has an index.

962,894. SHOE FOR PRESSING IRON STANDS; F. E. Emery, New York, N. Y. App. filed Dec. 3, 1908. A shoe with guards preventing lateral movement of the iron while on the stand, so as to avoid accidental engagement of the iron with the switch mechanism.

962,921. TERMINAL FOR ELECTRIC CONDUCTORS; E. Schneider, New York, N. Y. App. filed Feb. 2, 1909. For securing a terminal to a conductor without solder by means of a pair of wings, one of which has a tongue and a notch.

962,923. PENDANT ELECTRIC SWITCH; F. E. Seeley, Bridgeport, Conn. App. filed Sept. 4, 1908. An inverted insulating cup carrying a push-button switch actuating a ratchet wheel and contacts.

962,936. SWITCH LOCK; P. F. Augenbraun, Stamford, Conn. App. filed Sept. 9, 1909. For locking a switch arm against movement by means of a fixed keeper and a lock carried by the arm and having a bolt to enter the keeper.

962,958. SOLENOID OPERATING MECHANISM; E. M. Hewlett, Schenectady, N. Y. App. filed Nov. 17, 1906. For operating switches in which the power is furnished by solenoids and the switches are operated by motors, the switch member having an actuating toggle with a movable abutment and locking means for holding the abutment immovable to enable the toggle when straightened to close the switch.

962,960. SEMAPHORE MECHANISM; W. K. Howe. Rochester, N. Y. App. filed May 19, 1909. A round signal mast, a semaphore support clamped around it and vertically and angularly adjustable thereon.

962,966. ELECTRIC RAILROAD BONDING SYSTEM; G. H. Lindsey, Austen, W. Va. App. filed May 26, 1909. A spliced bar with grooves between the bolt openings and a U-shaped bond with its connecting member in the groove, the arms of the bond being threaded.

962,989. ELECTRICALLY HEATED FLATIRON; G. E. Stevens, Lynn, Mass. App. filed May 8, 1909. The handle, when grasped, throws the current on and when released cuts it off, by means of a spring-pressed member clamped to the handle and actuating the switch.